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PROCEEDINGS OF THE FIRST PAN-AFRICAN CONGRESS ON PREHISTORY, 1947

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PREFACE

As a result of correspondence with leading Prehistorians all over Africa during 1943 and 1944, it became increasingly clear that there was an urgent need for workers in the fields of Prehistory, Quaternary Geology and Palaeontology in this continent to get together and discuss mutual problems at the earliest possible opportunity.

After various other suggestions for a convener and a venue had failed to materialise, I volunteered to try and organise a Pan-African Congress on Prehistory in Nairobi as soon as possible after the end of the war.

In February 1945 therefore, I made a first approach to the Kenya Government and after much correspondence it was finally agreed that I might convene a Congress in Nairobi in January 1947.

My wife and I then set to work to get the necessary organisation going, ably assisted by Miss Margaret Tate. The Governments of Kenya, Uganda, and Tanganyika, all agreed to contribute towards the cost, while members of the Nairobi Chamber of Commerce and many private individuals as well as the Municipal Council rendered invaluable co-operation, and gave us financial assistance.

Many apparently unsurpassable difficulties had to be overcome, not least of which was the finding of suitable accommodation for the delegates, but numerous Nairobi citizens came to our aid and offered hospitality and accommodation in their private houses. The organisation of excursions too, presented considerable difficulties owing to the fact that reliable transport was still very scarce after the war years.

In due course, however, the Congress was born, the delegates arrived, and the opening session was addressed by His Excellency, the Governor of Kenya on January 14th, 1947.

Difficulties connected with the Congress did not however end with the holding of the Congress, and from the moment that I started upon the task of trying to get the Proceedings published, I was met with one obstacle after another. Paper shortages at first made numerous publishing houses decline to undertake the work, or led them to submit estimates so prohibitive that their acceptance was out of the question. At long last a publisher was found, but printing costs and paper shortages contrived to cause much worry and in the end it has been necessary to reduce the size of the

proceedings very severely by drastic sub-editing. This seemed preferable to having the Proceedings delayed any longer. It had been originally planned to publish the majority of papers in full, with many illustrations where required, but this has proved out of the question in the circumstances. As editor-in-chief, I make my deepest apologies to the various authors for this.

I would like to place on record my gratitude to Mr. Malan and Dr. Wells for their work in the preliminary stages of editing the papers, and to Mrs. S. Cole for having so ably carried out the thankless task of cutting the papers still more drastically and making summaries where necessary.

L. S. B. Leakey,
General Secretary.

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THE PAN-AFRICAN CONGRESS ON PREHISTORY

Nairobi, January, 1947

LIST OF OFFICE BEARERS

President	Prof. Abbé Henri Breuil
Vice-President	Dr. Robert Broom, F.R.S.
Organising and General Secretary	Dr. L. S. B. Leakey
Assistant Secretaries	Mr. B. D. Malan
	Mr. Desmond Clark

Section I—Geology, General Palaeontology and Climatology

Chairman	Prof. A. du Toit, F.R.S.
Vice-Chairmen	Dr. E. Nilsson
	Prof. C. Arambourg

Section II—Human Palaeontology

Chairman	Prof. R. Dart
Vice-Chairmen	Prof. Le Gros Clark, F.R.S.
	Prof. M. R. Drennan

Section III—Prehistoric Archaeology

Chairman	Dr. L. S. B. Leakey
Vice-Chairmen	Prof. C. van Riet Lowe
	Prof. Mustafa Amer Bey

RULES AND CONSTITUTION

PREAMBLE

The delegates to this Congress are of the opinion that it is imperative that the collaboration in the fields of Prehistory and Tertiary and Quaternary Geology and Palaeontology, which has been initiated in this first Pan-African Congress on Prehistory held in Nairobi in January, 1947, should be permanently established.

Congress therefore resolves that this aim be achieved by the setting up of the necessary machinery for the above purpose as set out below :—

(1) That the Pan-African Congress on Prehistory shall meet every four years or at such other interval as circumstances shall dictate.

(2) That the Office-Bearers elected at any Meeting shall hold office until the succeeding meeting ;

(3) That the Organising Secretary of any particular Meeting shall act as General Secretary during the interval between one Congress and the next ;

(4) That it shall be left to the Authorities of the inviting Country to appoint in advance, the Organising Secretary for the Congress to be held in their Territory ;

(5) That the Office-Bearers to be appointed by Congress shall consist of a President, one or more Vice-Presidents and three Chairmen (with necessary, Vice-Chairman) of the following sections :—

(*a*) Prehistoric Archaeology.

(*b*) Geology, General Palaeontology and Climatology,

(*c*) Human Palaeontology.

(*d*) Any other Sections deemed necessary.

(6) The Organising Secretary shall be an *ex officio* Member of the General Committee which shall consist of President, Vice-President, or Vice-Presidents, and the Chairmen of the several Sections.

(7) Such Sub-Committees as may be deemed necessary shall be nominated by the General Committee and the names submitted to Congress for approval ;

(8) That one or more Standing Sub-Committees on various subjects may be appointed to hold office from one Congress until the next ;

(9) That the General Committee shall deal with all recommendations and resolutions passed to them by individual Members of the Congress, by Sub-Committees or by resolutions from the General Sessions and shall present such recommendations and resolutions to Congress in plenary session for ratification ;

(10) The proceedings of the Congress shall be published as soon as possible after Congress is over in such detail as financial circumstances shall allow.

GENERAL RESOLUTIONS

Resolution 1

As a result of the Meeting of the First Pan-African Congress on Prehistory held in Nairobi in January, 1947, and attended by Delegates of twenty-six countries, vast strides have been made in the advancement of the study of Prehistory not only as it affects the African continent but also generally.

The growing recognition of the educational and scientific importance of this subject is shewn by the fact that the Government of the Union of South Africa has issued an invitation, for the Congress to hold its second meeting in South Africa in 1951, which invitation has been unanimously accepted.[1]

Official surveys are in existence and active in Egypt and The Union of South Africa and the Belgian Congo, but in most other countries of Africa research work has been carried out privately without official assistance.

Congress therefore respectfully wishes to bring to the attention of the Governments concerned the extreme importance of the study of Prehistory in Africa and urges upon them the imperative need for further and immediate systematic research on an adequate scale, under full scientific direction and with official support, in the territories under their control.

Resolution 2

The Congress respectfully submits to the Governments of all Countries interested in research in the African field the general resolution which it has sent to the Governments which have territories in Africa under their direct control and requests their active co-operation in the furtherance of the study of Prehistory in Africa.

Resolution 3

This Congress being fully aware of the personal interest of His Imperial Majesty the Emperor of Ethiopia in the study of the past history of his country, as has been shewn by his encouragement of scientific research, expresses the sincere hope that he will advise his Government to extend such work within his Empire, possibly with the co-operation of research workers from other countries which are interested in the Prehistory of the African Continent.

Resolution 4

Congress has been greatly impressed by the evidence which has been laid before it by the Delegates from Angola which shows that this Portuguese Colony is potentially very rich in evidence relating to the Stone Age. Congress expresses its admiration for the work already done by a small band of enthusiasts.

Congress respectfully requests the Governor of Angola to take such steps as may be necessary to ensure that prehistoric research in that country be continued by the appointment of a suitable person to devote his whole time to such work in collaboration with the Geological Survey and with the Museum of Angola, with a view to the establishment of a permanent and official archaeological survey of Angola.

[1] Unfortunately it has been impossible to arrange for the meeting to take place in South Africa. The next Congress will be held in Algiers.

Resolution 5

This Congress has been greatly impressed by the evidence which has been laid before it by the Delegates from the Belgian Congo which shows that this Belgian Colony is extremely rich in evidence relating to the Stone Age.

Congress further points out the importance of the proximity of the Belgian Congo Territory on the one hand to East Africa and on the other hand to South Africa, in both of which areas very important fossil evidence relating to the origin of man has been found. Congress expresses its admiration for the work already carried out in the Congo with the support of the Government but feels that the situation is so important as to warrant a more intensive survey.

Congress therefore respectfully requests the Belgian Government to take such steps as may be necessary to ensure that Prehistoric Research in the Belgian Congo be continued and also extended.

Resolution 6

The Pan-African Congress on Prehistory representing twenty-six countries, wishes respectfully to draw the attention of the Governments of the East African Territories to the urgent need of placing the study of Prehistory in these territories upon a firm foundation.

The work already carried out has clearly shewn that these territories are extraordinarily rich not only in remains of the Stone Age but in the essential geological and palaeontological evidence by means of which the remains may be dated.

Congress understands that proposals which have had the general approval of His Majesty's Government through the Colonial Office have already been submitted by Dr. L. S. B. Leakey at the request of the Governors' Conference and Congress urges that these proposals be implemented with as little delay as possible.

Congress would further point out that it would be of extreme value to the proposed East African Archaeological Survey if it could have the specific services of a Pleistocene Geologist and a Pleistocene Palaeontologist.

The Pan-African Congress on Prehistory has been deeply impressed by the valuable collections already on display in the fields of Zoology, Botany, Anthropology, Palaeontology and Geology in the Coryndon Museum. It recognises however that the facilities at the disposal of the Museum for the exhibition and study of the collections are inadequate. In view of this, Congress expresses the hope that the establishment of the proposed Archaeological Survey of East Africa will be linked with the Coryndon Museum, and Government is therefore respectfully invited to consider the early provision of more extensive Museum accommodation, laboratory facilities and staff, so that the Museum may be enabled to discharge its functions effectively in the scientific education of the public and become the nucleus of a future East African institution of higher scientific studies.

Resolution 7

This Congress, after considering the importance of the study of Prehistory in the African continent as a whole, feels that a serious problem is presented through the limited amount that is as yet known about the Stone Age in the vast Colony of Nigeria.

The little that research workers have been able to achieve in their spare time indicates, unquestionably, that a wide and important field awaits exploration.

Congress therefore respectfully recommends the Government of Nigeria to give serious consideration to carrying out a preliminary survey in Nigeria with a view to reporting to the Second Pan-African Congress which, at the invitation of the Government of the Union of South Africa, is to be held in South Africa in 1951.

Resolution 8

The Pan-African Congress on Prehistory wishes to draw the attention of the Governments of the Rhodesias and Nyasaland to the need for placing the study of Prehistory in their Territories upon a firm foundation by the establishment of an archaeological survey for the combined territories.

The work already carried out has clearly shewn that these Territories are rich, not only in remains of the Stone Age, but in the essential geological and palaeontological evidence by means of which the remains can be dated.

Congress further points out that it would be of very great value to the projected Rhodesian and Nyasaland Archaeological Survey if it could have the specific services of a Pleistocene Geologist and a Pleistocene Palaeontologist.

Resolution 9

This Congress has been greatly impressed by the excellent and valuable preliminary investigations into the Prehistory of Somaliland which have already been carried out and which show the great importance of this area as a potential link between Africa and Asia. The Congress therefore impresses upon the Government of Somaliland the need to appoint at an early date a qualified research worker to continue the work already initiated and to undertake a still more detailed survey of the Prehistory of this territory with a view to reporting at the Meeting of the Second Pan-African Congress on Prehistory which will be held in South Africa in 1951 at the invitation of the Government of the Union of South Africa.

Resolution 10

This Congress realising the great importance and urgent need for archaeological progress in French West Africa, recommends that the Government of French West Africa should take steps as soon as possible with a view to appointing a specialist on Prehistoric Archaeology at the *Institut Français D'Afrique Noire.*

Resolution 11

In view of the special importance of Prehistoric Research in Egypt and adjacent countries for the purpose of unravelling the Prehistory of that crucial region of the Old World as well as for purposes of correlating and dating other and similar prehistoric cultures in the Continent of Africa, the Pan-African Congress on Prehistory strongly recommends that the Government of Egypt take urgent and effective steps to organize and encourage Prehistoric Study and Research in their Territory. Congress also respectfully suggests that your

Government might encourage collaboration with interested organisations in the adjacent Countries for the furtherance of their common aim in view of the important links which Egypt provides with Asia.

Resolution 12

This Congress has been greatly impressed by the evidence which has been laid before it by the Delegates from Mozambique which shows that this Portuguese Colony is clearly very rich in evidence relating to the Stone Age. Congress expresses its admiration for the work already done by a small band of enthusiasts.

Congress respectfully requests the Government of Mozambique to take such steps as may be necessary to ensure that Prehistoric Research in that Country be continued by the appointment of a suitable person to devote the whole of his time to such work in collaboration with the Geological Survey and with the Museum at Lourenco Marques with a view to the eventual establishment of a permanent and official Archaeological Survey of Mozambique.

Resolution 13

Preservation of Prehistoric and Palaeontological Sites

This Congress recommends that the Governments of those Countries in Africa where there is no legislation to protect prehistoric and palaeontological sites and ensure systematic excavation, should take steps to introduce such measures as are deemed necessary.

The Congress further recommends that legislation which is in operation in Egypt, in East and South Africa, in Southern Rhodesia and elsewhere in the African continent should be taken into consideration. The recommendations set out in the '*Acte Final de la Conference du Caire*' published in 'La Technique de Fouilles' by the Institution of International Intellectual Co-operation in Paris in 1939 should also be consulted.

Congress further recommends that in those Countries where protective legislation already exists, such legislation should be reviewed from time to time to ensure that genuine scientific workers are not hampered.

Congress lays particular stress on the fact that it is aware that legislative measures are ineffective by themselves and recommends that legislation be reinforced by such steps as the erection of fences, the placing of warning notices, and more particularly by the appointment of Official Caretakers. Congress recommends this latter step as imperative wherever practical.

Resolution No. 14

(This resolution is based upon the report of the sub-committee on Geology, General Palaeontology and Climatology, appointed by the Pan-African Congress on Prehistory, which met on Friday afternoon, January 17th, 1947)

This Pan-African Congress on Prehistory recognises the great difficulty in applying to Africa the standard European geological terminology for the period just before, during and after the European Ice Age and recommends that—

(1) Africa should be treated for the time being as a geological unit distinct from Europe for this period and an African nomenclature should be used

for the deposits and faunas of the period in this Continent, excluding the North African littoral.

(2) The established succession of deposits and faunas in East Africa should be used as a basis for the development of the African terminology.

(3) Certain statigraphical units should be recognised in East Africa from now onwards. They are :—

Nakuran
Makalian
Gamblian
Kamasian
Kageran

(4) These Resolutions should be forwarded to the Secretariat of the 18th International Geological Congress in London for consideration.

(5) That a Standing Committee should be formed to consider questions of nomenclature which may arise before the next Pan-African Congress on Prehistory meets, this Committee to consist of the following persons :— Professor C. Arambourg, Mr. M. L. Barradas, Dr. Corin, Dr. S. H. Haughton, Mr. J. Janmart, Engineer F. Mouta, Dr. E. Nilsson, Dr. K. Oakley, Professor A. F. E. Zeuner, Mr. G. Andrew, Dr. Huzayyin, Miss D. Bate, Dr. Grantham and Dr. L. S. B. Leakey.

Resolution No. 15

(Based upon the report of the Sub-Committee on Human Palaeonotology)

1. Physical survey of existing African populations

This Congress recommends that, in order to provide the necessary comparative material for the understanding of fossil remains, Governments of African Territories be urged to foster and make provision for :—

(*a*) The Anatomical and Anthropological Studies of African Peoples, and
(*b*) The Collection, Preservation and proper study of Skeletal Material of these Peoples.

2. Publication of scientific reports

This Congress recommends to Governments of African Territories supporting Scientific Institutions that these Institutions be informed that if they have the custody of Human Palaeontological material considered to be of importance they should make arrangements for its study by a competent anatomical expert with a view to the submission of a detailed anatomical report upon the material within three years.

3. Subvention of publication

This Congress recommends that Governments of African Territories be urged to make funds available for the publication, in the form of separate memoirs, of researches in Human Palaeon-

tology and related sciences which are considered by experts in these fields to be of importance and for which no other avenue of publication is open.

Resolution No. 16

(*Based upon the Report of Sub-Committee on Prehistoric Archaeology, held at* 4.30 *p.m. on Tuesday, January* 21*st,* 1947)

1. That all terms which have hitherto been used in Africa to describe the major divisions in the cultural succession of the Old Palaeolithic or Earlier Stone Age be discontinued, and that the term Chelles-Acheul be substituted, with the appropriate use of local regional terms. The new term excludes advanced or localised derivatives as for example, the Fauresmith and the Sangoan.

2. That the use of the word Clacton as a term to describe a technical process of manufacture be discontinued in Africa, and that the expression block-on-block be substituted.

3. That the word Levallois as a term to describe a technical process of manufacture be discontinued in Africa and that the expression faceted platform technique be substituted, with any such necessary additions as side, end, corner, diagonal, etc. as may be required.

4. With reference to the use of a term covering what has hitherto been described by Dr. L. S. B. Leakey in his ' Stone Age Cultures in Kenya Colony ' and subsequent papers under the name of Kenya Aurignacian, the majority of the Sub-Committee recommends that in view of the fact that microlithic elements occur throughout the Capsian of North Africa, and in spite of our present localised knowledge of the Capsian, the word Kenya Capsian be substituted directly. Professor C. van Riet Lowe and Dr. Huzayyin dissented.

5. In consideration of the agreement reached at the plenary session of the Congress between Dr. L. S. B. Leakey and Dr. F. Cabu, it is agreed to recommend that the term Sangoan be used as far as, and including, that portion of the Tumbian as described by Oswald Menghin to which Messrs. Collett and Cabu have applied the term Djokocian and Kalinian in the Congo Basin. It is similarly agreed that the term Sangoan be used as far as and including the Middle Tumbian as described in Dr. L. S. B. Leakey's and Archdeacon Owen's paper of March 1945. It is further recommended that the term Kenya Lupemban be substituted for the Upper Tumbian of Kenya.

6. In view of the substitution in paragraph 1 above, it has been found necessary to recommend that the term Pre-Chelles-Acheul be used in preference to African Pre-Chellean, Pre-Palaeolithic, etc.

7. That while retaining the term Pre-Chelles-Acheul as a general term, the terms Oldowan and Kafuan be employed to describe respectively the later and earlier stages of the Pre-Chelles-Acheul culture which have already been defined under those names, and that suitable regional qualifications be added.

8. That with respect to cultural terms it shall not be necessary to employ a regional term in the type area.

9. (*a*) That a permanent Consultative Committee on African Terminology be established.

(*b*) That this Committee be made up of five representatives, one from each of the following regions :
North-East Africa, North-West Africa and the Sahara, West Central Africa, East Africa and South Africa.

(*c*) That all workers in African Prehistory be invited to submit any fundamental alterations or additions prior to publication, together with an adequate *précis* and illustrations to this Consultative Committee.

10. That the following Consultative Committee be appointed :

North-East Africa :	Prof. Mustafa Amer Bey.
North-West Africa and the Sahara :	Dr. A. Ruhlmann.
West Central Africa :	Dr. F. Cabu.
East Africa :	Dr. L. S. B. Leakey.
South Africa :	Prof. C. van Riet Lowe.

Resolution No. 17

This Congress, having been informed by the Abbé H. Breuil, Member of the *Institut de Paléontogie Humaine*, Professor at the *Collège de France*, President of the Pan-African Congress on Prehistory, of the exceptional importance, for determining the geological and archaeological chronology of the Moroccan Quarternary, of the sequence of the beds observed in Sidi Abderrhamane Quarry, near Casablanca, recommends that a site of such outstanding importance should be preserved for future international scientific investigations and be declared a scheduled monument as has been done with valuable Prehistoric Sites in other African

Countries such as Egypt, the Union of South Africa and Mozambique. Congress emphasizes the necessity for preserving this particular site and asks the Cherifian authorities to take the necessary protective measures as soon as possible. Congress hopes that the Schneider Company which has already done so much to further the valuable work of Messrs. Neuville and Ruhlmann will not fail to follow the example of private companies in South Africa and elsewhere which in similar circumstances have shewn a high and generous understanding of their responsibilities to the scientific world.

The areas to be preserved if possible are as follows :—

(1) All that part where the lower beach is visible to the north of the little cave and including it.

(2) A part of the Milazzian Cliff at the entrance of the quarry together with the caves in this cliff cut into it by the Tyrrhenian Beach and the talus of pebbles piled up against the cliff by the waves of that period.

Congress further respectfully recommends that a section of the Martin Quarry at El Hank, with an important part of all the levels which it covers, should be preserved for future research.

LIST OF DELEGATES TO PAN-AFRICAN CONGRESS

Name	*Country*	*Representing*	*Postal Address*
AKALOU, Mr. W. B.	Ethiopia	Imperial Ethiopian Govt.	P.O. Box 393, Addis Ababa
ANDREW, Mr. G.	Sudan	(*a*) Sudan Government (*b*) Geological Survey of Sudan	P.O. Box 410, Khartoum
ARAMBOURG, Prof. C.	France	Museum National d'Histoire Naturelle	Laboratoire de Paléontologie 3 Place Valhubert, Paris (5e)
ARKELL, Mr. A. J.	Sudan	(*a*) Sudan Government and (*b*) Archaeological and Anthropological Commission	P.O. Box 178, Khartoum (now Dept. of Egyptology, Univ. College, London, W.C.1.)
BARRADAS, Engineer Lereno	Mozambique	(*a*) Government of Mozambique (*b*) Peparticao Tecnica de Industria E Geologia	Mozambique, Portuguese East Africa
BATE, Miss D. M. A.†	Great Britain	British Museum (Natural History)	British Museum (Natural History), Tring, Herts.
BOND, Mr. Geoffrey	Southern Rhodesia	(*a*) National Museum of S. Rhodesia	P.O. Box 240, Bulawayo
		(*b*) Imperial College of Science and Technology, London	(Now Rhodes Livingstone Museum, Livingstone, N. Rhodesia)
BREUIL, Prof. L'Abbé H.	France	French Government and College de France	University of Witwatersrand, Johannesburg, S. Africa (Now 52 Av. de la Motte, Picquex, Paris XV)
BROOM, Dr. Robert, F.R.S.†	South Africa	Transvaal Museum	P.O. Box 413, Pretoria, Transvaal, S. Africa.
BURNEY, Mrs.	England	Private Member	39A St. Giles, Oxford, England

Name	*Country*	*Representing*	*Postal Address*
CABU, Dr. F.	Belgian Congo	(*a*) Belgian Govt. (*b*) Belgian Congo Govt. (*c*) Musée du Congo Belge, Tervuren (*d*) Musée, Leopold, Elizabethville	Elizabethville
CLARK, Prof. W. E. Le Gros, F.R.S.	Great Britain	(*a*) Oxford University (*b*) The Royal Society	University Museum, Oxford, England
CLARK, Mr. J. D.	Northern Rhodesia	(*a*) The Govt. of N. Rhodesia (*b*) The Rhodes-Livingstone Museum	Rhodes-Livingstone Museum, Livingstone, N. Rhodesia
COLE, Mrs. S.	Kenya	Private Member	P.O. Naro Moru, Kenya Colony
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SECTION I

GEOLOGY, GENERAL PALAEONTOLOGY & CLIMATOLOGY

Chairman: Prof. A. du Toit, F.R.S.
Vice-Chairmen: Dr. E. Nilsson Prof. C. Arambourg

Wednesday, January 15th

THE AFRICAN PLEISTOCENE MAMMALS

C. Arambourg

Until the beginning of this century, the extent of our knowledge concerning the faunas of the African Plio-Pleistocene mammals was limited to evidence from a few North-African beds, which had been described by Phillippe Thomas, and more especially by Pomel.

In 1903, the French Mission of Bourg de Bozas discovered in South Abyssinia, the widespread beds of the Omo Valley, and brought back to Europe the most characteristic elements of the fauna living in Central Africa in the beginning of the Quaternary. Later on, the expansion of European penetration made known a whole series of deposits in Tanganyika, Kenya and South Africa, whose exploitation yielded rich material and confirmed the curious association of recent and archaic elements, whose presence had been detected in the Omo Beds. At the same time, the discovery, *in situ*, of human industries in Pleistocene levels, permitted the establishment of a chronology related to faunal elements. Nevertheless, the Omo Beds remained little accessible, and it was only in 1932, that a mission, conducted by the writer, undertook a methodical investigation and study of the latter.

The analysis and description, now completed, of the material collected in the course of this expedition, allows the presentation of the results obtained in the different African beds, as well as a new general exposition of our knowledge concerning the Quaternary Fauna of Africa.

The Omo Beds Fauna

The Omo Beds cover an extensive area lying from the foot of the Lubur Mountains, on the western banks of Lake Rudolph, to more than a hundred kilometers northwards, with an average width of twenty kilometers. They correspond to the oldest deposits of a big lacustrine or marshy depression connected with the Nile basin, whose formation, consequent on the big collapse of the Rift Valley, corresponds to the very beginning of the Quaternary. The fauna consists of fishes, reptiles and mammals.

The fishes belong to forms closely related to, or identical with, living species of the Nilotic fauna: *Polypterus*, nearly allied to

P. bichir, *Lates niloticus*, *Tilapia*, allied to *T. nilotica*, *Clarotes laticeps*; and a curious *Trigonidae*, probably allied to the South-American *Potamotrygons*.

The reptiles, chelonians and crocodiles, belong to the living African fauna, except one crocodile, which is special and related to the Indonesian *Tomistoma*.

The mammals are the prevailing elements. They consist of: Proboscidians: *Dinotherium Bozasi*, *Archidiskodon cf. planifrons*, *A. Recki*; Perissodactyls: *Rhinoceros simus germano-africanus*, *Stylohipparion albertense*, *Equus cf. zebra*; Artiodactyls, which are by far the most numerous: Hippopotamidae, with the curious *H. protamphibius* that, though being a tetraprotodont, possesses characters reminding one both of those of the Hexaprotodontae and of the genus *Choeropsis*; Suidae, among which is the special genus *Omochoerus*, and different types of Phacochoerinae: *Metridiochoerus*, *Notochoerus*, *Phacochoerus*, whose identity as well as affinities, sometimes questioned by certain writers, it has been possible to ascertain; Giraffidae, with *Sivatherium olduvaiense*, and two giraffes, one of which is probably identical with the living species; numerous Bovidae, among which a special genus: *Menelikia lyrocera*, and several forms, more or less related to living species, of the genus *Tragelaphus*, *Kobus*, *Redunca*, *Strepsiceros*, *Taurotragus*, *Alcelaphus*, *Aepyceros*, *Gazella*, *Antidorcas*, *Syncerus*, etc.

Carnivora are not numerous; they are represented by a unique Machairodontidae of the genus *Homotherium*; the same may be said of Primates, with only one genus: *Dinepithecus*, and one species, allied to *Theropithecus gelada*. We must, moreover, point out that the 'little fauna': small carnivores, rodents, insectivores, hyracoids, etc., as well as birds, are entirely missing. The absence of birds is rather surprising, if we consider that the deposits we are now dealing with were formed in a lake depression of little depth, and it contrasts with the extraordinary abundance of water birds living on the shores of Lake Rudolph to-day.

This fact, in my opinion, may have been caused by the intense volcanic activity prevailing at the time in this region, when newly-opened craters were pouring their ejectamenta and lava into the sinking depression, thus creating conditions obviously unfavourable to avian life.

From a bionomic standpoint, the Omo Fauna is essentially a savanna and damp meadow fauna, containing very few forest and mountain elements. A noteworthy fact about it (as those who had first studied it pointed out, for instance, Haug, 1911) is the association of Tertiary elements, such as *Dinotherium*, *Stylohipparion*,

Sivatherium, with others of more recent date, such as : *Elephas*, *Equus*, *Giraffa*, *Syncerus*, and various Antelopes, etc.

Comparison with the Fauna of Other African Beds

The principal beds which can be compared with the Omo deposits are the following :

(1) In East-Africa, the Kaiso beds, near Lake Albert-Edward ; the Homa beds (Kanam and Kanjera), near Lake Victoria ; the Oldoway and Serengeti or Laetolil deposits, in Tanganyika Territory.

(2) In South-Africa, the Transvaal Australopithecidae Cave-Beds, as well as those of alluvial valley-terraces.

(3) In North-Africa, these of the Constantine Plateaux, till now considered as Villafranchian ; the more recent beds of Palikao and Aboukir, in Oran and the Rabat Sandstone Beds, in Morocco.

East African Beds[1]

The Serengeti and Oldoway deposits, which are also the most numerous, share a dozen species with the Omo beds, among which the most characteristic forms to be found are : *Dinotherium Bozasi*, *Archidiskodon cf. planifrons*, *A. Recki*, *Stylohipparion albertense*, *Sivatherium olduvaiense*, *Notochoerus capensis*. It is however to be noted that *A. cf. planifrons* is missing in the Lower Oldoway levels, and that, in the Serengeti level, there exist, besides, a Mastodon of the genus *Anancus*, and a Chalicotheriidae : *Metaschizotherium Hennigi*. The Serengeti fauna, consequently, possesses a more archaic character than that of Oldoway and, according to Kent's opinion (1942), that fact would be corroborated by the presence, in that bed, of human implements more primitive than those discovered in the lower Oldoway horizon ; the Serengeti series would then correspond to the lower level of the Pleistocene ; that of Oldoway, to the Middle Pleistocene.

The other East-African deposits belong to several Quaternary levels. The oldest ones are the Kaiso and Kanam deposits ; they compare well with the Serengeti beds ; in fact, they contain, with *A. planifrons*, *Dinotherium Bozasi*[2] *Stylohipparion albertense*, and different other forms of a more recent character, certain archaic elements, such as *Stegodon kaisensis*, with the addition of a Chalico-

[1] In the full description of the Omo Fauna (Omo Mission, t.I, fasc. 3, Contribution . . . Part 2, Palaeontology), a rational synonym, such as I conceive it, of the different East and North African Quaternary species, will be found.

[2] Not indicated at Kaiso.

theriidae in the Kaiso level, and of *Anancus kenyensis* in the Kanam level. The latter, according to Kent (*op. cit.*) would have yielded, as well as that of Serengeti, a human industry with implements still more primitive than those of the lower Oldoway level.

Again according to Kent's assertions, the Rawi and Kanjera beds would be, stratigraphically, more recent than the preceding beds, and would correspond to the Middle Pleistocene ; in other words, they would be equivalent to the Oldoway series. Their fauna is remarkable by the total absence of the most archaic-Proboscidians, such as *A. planifrons*, *Anancus* and *Stegodon*, replaced, at Rawi, by *A. Recki* and at Kanjera, by a form closely allied, at least by its dental morphology,[1] to *E.* (*Loxodonta*) *atlanticus* Pomel, of the North-African Middle Pleistocene.

In spite of the fact that the Omo Fauna contains neither Mastodonts nor Chalicotheriidae, the presence of *A. cf. planifrons* confers upon it an archaic character that allows one, by establishing a parallel between its fauna and that of Serengeti, Kaiso and Kanam, to attribute it to the early Pleistocene. This attribution, is moreover confirmed by Fuchs's discovery (1939) of human implements of an Abbevillian type (Chellean), in the lake terraces of the Lake Rudolph basin, which are more recent than the Omo Beds.

South African Beds

These beds are of two kinds :

(1) the Australopithecidae Cave-Beds.

(2) the alluvial Terrace-Valley Beds.

According to Broom, the cave deposits are apt to be found from the Middle Pliocene (*Australopithecus* cave, at Taungs, and *Plesianthropus* and *Lycyaena* cave, at Sterkfontein), to the lower Pleistocene (*Paranthropus* bone breccia, at Kromdrai).

Unfortunately, their fauna is not easily compared with that of other African deposits because, owing to local circumstances, it is quite peculiar, and it chiefly contains ' little fauna ' specimens, with numerous monkeys and carnivores.

I will, however, mention the fact that portions of *Dinopithecus* and *Notochoerus*[2] (often found in Omo fauna) have been collected in the Sterkfontein Cave, as well as a big *Equus* closely related to *E. Zebra*.

The alluvial deposits that have yielded both fossils and human

[1] Mac Innes (1940), p. 94, Pl. VIII, fig. 4 and 5) has attributed such a tooth shape to *Palaeoloxodon antiquus Recki*.

[2] This genus also exists in the Tanganyika deposits and those of the banks of Lake Victoria.

industries, belong, in the Vaal Valley, to the ' Younger Gravels ' series of the South-African geologists, a series whose terraces are found at various altitudes relative to actual *thalwegs* ; unfortunately the localization of the fossils discovered there has not always been clearly indicated by their finders, and it is much to be desired that precise information, stratigraphic as well as paleontologic, should be obtained in this matter.

However, certain important facts seem to be well established, among which we may note the following :

(1) In the higher ' Younger gravels ' terraces (those that reach about 80 feet above the *thalwegs*), the association of primitive human industries, of the Abbeville-Clactonian (Stellenbosch) type, with a fauna characterised by primitive Proboscidians : Mastodon: *Archidiskodon cf. planifrons*,[1] a Sivatheriidae (*Griquatherium*), *Hippopotamus amphibius*, *Equus sp.*, and a few big Phacochoerinae : *Notochoerus capensis*, *Mesochoerus* (*Hylochoerus?*) *paiceae* etc. In the Orange Free State, near Cornelia, the base of the alluvial formations contains *Stylohipparion cf. albertense*, *Equus Louwi* (closely allied to *E. Stenonis*), *Metriodiochoerus andrewsi*, *Phacochoerus africanus fossilis* and an equidae of a special genus : *Eurygnathohippus*.

(2) In the more recent terraces (not higher than 40 feet), with industries of an Acheulean type (Fauresmith industry), are to be found elephants which I believe to be closely related to *E. Recki* and *E. atlanticus*.

It is evident then that, in South Africa, there exist faunal elements quite similar to those of East Africa and comparable stratigraphic divisions.

North African Beds

Among the deposits which have yielded fossil animals, we must eliminate the Upper Pleistocene cave deposits, whose fauna is characterised by the presence of European elements only recently immigrated, such as *Rhinoceros mercki* ; Cervidae (*Megaceroides*) ; bears, wild boars, etc.

Among the alluvial Algerian beds, those of Palikao, near Mascara, Lake Karar and Aboukir (Oran dep.) belong to the Middle Pleistocene, since they contain an industry of Acheulean type.

Their fauna contains essentially *Elephas* (*Loxodonta*) *atlanticus*, *Atelodus simus*, *Hippopotamus amphibius*, *Giraffa camelopardalis*, *Equus*

[1] I put together, under that name, all the isolated material, often fragmentary, which has been described under different names, such as : *A. planifrons*, *subplanifrons*, *Andrewsi*, *Griqua*, *Milleti*, *Vanalpheni*, *Broomi*. *Yorki*, etc.

mauritanicus ; a Machairodontidae and different ruminants of a tropical African type. We may note, then, that the essential elements characterising the older horizons of the East-African Pleistocene are missing, and that these levels seem to correspond to those of Oldoway and Kanjera.

In Morocco, the Rabat Sandstone is the equivalent of the Oran beds, but their basic conglomerates, which have produced an Archidiskodont closely related to *E. Recki*, could correspond to a somewhat older level.

The Constantine Plateaux beds are formed of lake deposits which have developed in the Setif region ; they have, until now, been attributed to the Upper Pliocene (Villafranchian). I resumed their study a few years ago, and more precise information concerning their fauna is now available. It is essentially characterised by the presence of primitive Proboscidians, such as: Mastodonts *Zygolophodon Borsoni* and *Anancus cf. kenyensis ;* Elephants : *Archidiskodon planifrons ;* tridactylous Equidae : *Stylohipparion setifense, Hipparion? mesostylum,* and Zebra Equidae : *Equus numidicus* (nearly allied to *E. Stenonis* ; Artiodactyla : *Hippopotamus amphibius, Giraffa cf. camelopardalis* and *Libytherium maurusium*, which is a Sivatheriinae, etc.

The association characteristic of the East and South-African Pleistocene beds is therefore to be found there, and I believe that, in the absence of serious contrary stratigraphic reasons, we are justified, at least for a while, in considering the Setifian levels as chronologically equivalent to them.

The African Quaternary Fauna

The facts we have just been discussing show that, in the early Pleistocene there lived, in Africa, a fauna characterised by a clearly African appearance, and by the survival of a certain number of archaic types which in Eurasia did not live after the end of the Pliocene, or did not even reach it. Such are Mastodonts : *Elephas cf ; planifrons ;* Chalicotheriidae, with a few special types : *Hip. protamphibius, Pelorovis, Bularchus*, etc.

That fauna, on the other hand, constituted a relatively homogeneous whole, for it covered the entire continent. The separation between Black Africa and Berber Africa, now created by the Saharan obstacle, did not then exist, and Mastodonts, Archidiscodonts, Stylohipparions, white rhinoceroses, big zebras, Sivatherinae, giraffes and hippopotamuses, freely covered a territory that extended from the Cape to the Mediterranean.

The evolution of that fauna, in the course of the Quaternary,

progressed regularly. By the end of the Lower Pleistocene, its most archaic elements : *Stegodon*, Mastodonts : *Archiskodon planifrons* and Chalicotheridae had already disappeared.

But, contrary to what happened in the greater part of the northern hemisphere, in which glacial advances had a strong influence upon the distribution and succession of Eurasiastic faunas, by causing deep transformations and important migrations, such modifications did not occur in Africa. On the other hand, almost completely isolated from the rest of the Old World, ever since the deepening of the Erythrean gap, that continent has received no new elements worth mentioning ; however, about the Middle Quaternary, a few Eurasiatic elements succeeded in entering it, either through Palestine or a temporary Sicilian-Tunisian road, but their area of penetration did not go southwards beyond the Saharan Atlas. It is, therefore, within strictly closed frontiers that the passage from Pleistocene to present day fauna was progressively accomplished : the latter, essentially, differs from the former by the extinction of archaic types with Mio-Pliocene affinities, and by the segregation of races or local varieties, from synthetic forms already in existence in the beginning of its history.

Relations and Origins of the African Fauna

We possess very little information about the mammalian faunas of the African Pliocene, and it is limited to that supplied by the Wadi Natrun Bed (Andrews, 1902) of the Middle Pliocene, in Egypt ; by certain South-African caves (according to Broom), and by a few other places in North Africa ; for instance, in the neighbourhood of Cairo (Arambourg, 1946), of Constantine (L. Joleaud, 1927), or in Tunisia (Solignac, 1927). Indications resulting from that study enable us to conclude that the Pleistocene fauna is directly related to that of the Lower or Middle Pliocene and that, for the present, only stratigraphic reasons or the presence of human implements enable us to distinguish the respective beds. That similarity of Pliocene and Quaternary faunas demonstrates the endemic character of living African fauna : Africa is indeed an ' old platform ', long since stabilised, where ethologic conditions varied but little since the Middle Tertiary, and where life developed with a regular rhythm. In fact, much earlier than the Pliocene, certain indications may be discovered of an already 'African' character in the local fauna, which are seen in paleontologic evidence of the lower Miocene of Kenya (Andrews, 1914), Kenya (C. Arambourg, 1933), Egypt (Fourtau, 1920), and South-West Africa (Stromer, 1926). Moreover, since the Oligocene, that

character is already confirmed, as everyone knows, by the presence of Proboscidians, Hyracoides, Artiodactyls and pre-anthropoid Simians.

It is, however, certain that Africa, long united with Asia, has constituted, with the latter, one of the principal evolutionary centres of the world, from which poured repeatedly, towards Europe and America, successive faunal waves of migration, for example that of the Pontian.

Also by reason of that union, faunal exchanges between the two big continents could go on actively until their separation was completed : thus it is that in Africa, about the end of the Miocene, the Equidae appeared, which had seemed to be missing before and, by compensation, its Proboscidians and Artiodactyls extended their territory as far as Asia. It is, in fact, with that country, rather than with Europe (and this is contrary to the general opinion) that the relations of the African Quaternary fauna most clearly appear. This is the reason why, during the course of the Pliocene and in the early Quaternary, the oldest elements have manifested undoubted Asiatic affinities ; among them we find : *A. planifrons, A. Recki, Anancus osiris, A. nyanzae, Stegodon, Sivatherium olduwaiense, Libytherium maurusium, Hexaprotodon hipponense, Bubalus palaeindicus, Bubalus antiquus* (et *B. Baini*), *Lycyaena Silberbergi.*

Their presence in Africa dates from the time when the African-Arab block though already injured by the Red Sea split, was not entirely dislocated. In later periods, in the course of one or of several sea regressions, coinciding, in the basin of the Mediterranean, with European glaciations, temporary communications were resumed with Eurasia, and certain holarctic elements, till then missing from Africa, found the possibility, as we have said, of entering it, though never going southwards, beyond the Atlas barrier.

In conclusion, we may say that Africa, long considered as a refuge offered to the remaining Tertiary fauna, is rather, in our opinion, a centre of evolution and dispersion from which certain groups, such as the Proboscidians, the Hyracoides, and some of the Artiodactyls, the Primates—and, among them, the anthropoids and probably the Hominidae—have differentiated and have, at successive periods, migrated towards Eurasia.

QUATERNARY EVENTS IN SOUTH AFRICA

H. B. S. Cooke

In a paper presented before the International Geological Congress in 1933, Professor R. A. Dart drew attention to some of the factors which had inhibited progress in Quaternary studies in South Africa and foresaw the directions in which future research should be aimed. Regrettably little has been accomplished as yet in the directions he advocated and much of the available evidence is being rapidly destroyed in the meantime. This account attempts to bring up to date some of the problems which were considered by Dart in his pioneer paper.

I. The Stone Age Cultural Sequence

Three major divisions of the cultural sequence in South Africa are recognised, each characterised by a different basic technique. The *Earlier Stone Age* employs a core and *bloc-en-bloc* anvil or Clacton flake technique and, in its later stages, a technique tentatively described as Proto-Levallois, seen in the Victoria West industry. *The Middle Stone Age* is characterised by a true Levallois technique and the *Later Stone Age* by a blade technique, together with other rather variable processes.

The line of demarcation between the Earlier and Middle Stone Ages is somewhat blurred by the occurrence of a mastery of the Levallois technique in the upper divisions of the former age, as well as by certain tool types that occur in both. The division between the Middle and Later Stone Ages, on the other hand, is much more distinct as no industry of the Later Stone Age contains true Levallois elements.

There is abundant stratigraphic evidence for the general succession within the Earlier Stone Age. Within the Middle Stone Age (usually shortened to M.S.A.) however, there are a number of distinct cultures whose intercorrelation is uncertain because of lack of geological evidence : the term M.S.A. Complex is accordingly used as a general descriptive term. Very probably these cultures overlap each other and are regional facies of the same complex. The final stage of the Pietersburg Culture seems, on evidence from the Border Cave, to foreshadow the Modderpoort Culture of the Orange Free State and the Transvaal. These two cultures appear to cover practically all the expected stages of typological development between the final Earlier Stone Age of the same area and the most advanced stages which preceded the Wilton Culture of the Later Stone Age. They may actually represent in

time almost the whole of the period of the M.S.A. Complex, though they do not include all the elements found in the Complex elsewhere. There is quite a fair amount of stratigraphic evidence for the sequence of the Later Stone Age cultures and in this period there is definite evidence of overlap both in time and space.

The clearest stratigraphic evidence of the cultural succession has been gained from the deposits of the Vaal River, where tools of the various phases of the Stellenbosch culture occur in terrace gravels sealed beneath calcified sands *on* which Fauresmith implements are found. Tools of the latter culture occur in gravels belonging to tributary streams of the Vaal River and are overlain by sands on which M.S.A. artefacts are abundant. Later Stone Age tools are found widely on the present surface, whereas M.S.A. usually occurs at some depth, usually in a grit band.

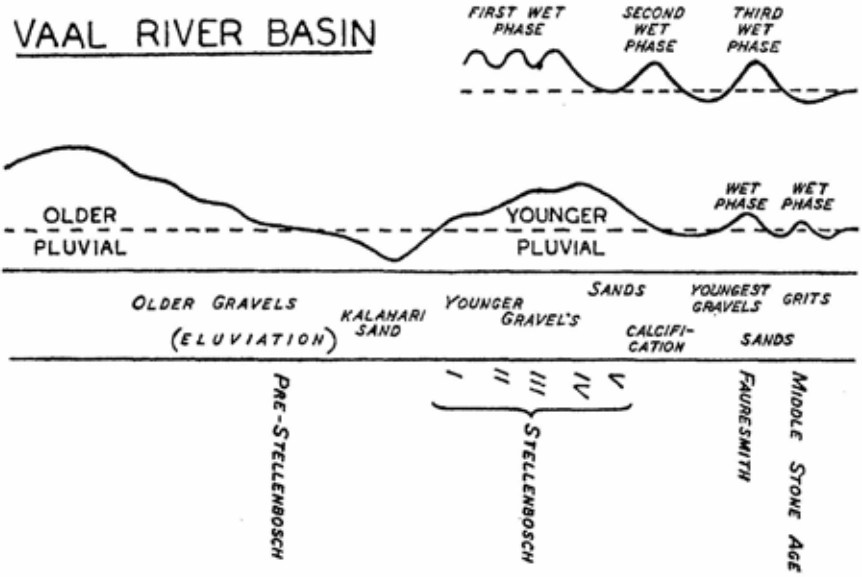
II. Climatic Changes

A joint survey of the Vaal River basin was carried out by the Union Geological Survey and the Union Bureau of Archaeology (now the Archaeological Survey) and the results of this work were published in 1937. The deposits of the river were grouped into high-level 'Older Gravels,' usually red in colour, and low-level 'Younger Gravels', while a group of 'Youngest Gravels' was recognised in the tributary valleys. In the Younger Gravels three phases of deposition were distinguished as Younger Gravels I, II and III. The gravels were found to lie beneath thick sand deposits, which are usually calcified.

The writer has recently concluded that the terrace formation was to a great extent controlled by rapid deepening of the tributary Hartz River in soft rocks and that river capture also played a part in the formation of the Older Gravels. There is, too, some indication of climatic changes and the Older Gravels are thought to have been deposited under conditions of high but declining rainfall, culminating in an arid period. The Younger Gravels apparently belong to a period of relatively high rainfall, and it is considered that the three phases recognised by Söhnge and Visser in these gravels are more in the nature of facies changes than distinct climatic terraces. A new curve of inferred climatic changes is reproduced here (Fig. 1), together with a representation of Söhnge and Visser's original curve.

The Younger Gravels have yielded a considerable number of mammalian fossils indicative of a Middle Pleistocene evolutionary stage. If this is the case, the Older Gravels are probably late Pliocene or Lower Pleistocene and the major erosion of the Vaal

River which preceded their deposition would extend back into the Pliocene. By inference the post-Younger Gravel deposits are Upper Pleistocene, as are also most probably the later phases of the Younger Gravels themselves.



Curve showing variations of rainfall on the Vaal River Basin during the Quaternary as inferred by the writer (centre) compared with (above) the curve given by Söhnge and Visser in 1937. The time scale is only very approximate. The correlation of the stone age cultures is shown below.

While the climatic sequence now indicated for the Vaal River basin may be regarded as fairly firmly established in outline, it cannot yet be considered justifiable to apply this sequence to South Africa as a whole. It does, however, provide a basis with which other work on Quaternary climates in this region may be compared.

The remarkable frequency with which South African rivers flow through alluvium, and how seldom they have banks consisting of the country rock, seems to demand a single explanation. It seems that at a not very distant date all or nearly all our rivers lost much of their transporting power and that aggradation was a widespread phenomenon. Subsequently the rivers recovered their ability to flow and seem to be now engaged in lowering their beds after having cut through the alluvial deposits. There is a strong probability that climatic changes have been in some way responsible.

At many points along the east coast of South Africa from Natal to Port Elizabeth there occur lines of reddish sand dunes which

run roughly parallel to the coast a mile or so inland. Mottled clays frequently lie at the base of the deposits and contain, in places, late Stellenbosch or Fauresmith implements. The clays are capped by stratified red dune sands on, or sometimes in, which Middle Stone Age tools occur. There can be little doubt of the origin of the clays in coastal fringing swamps, which apparently dried up before M.S.A. times. It is, however, impossible to say in what measure this is due to retreat of the sea (of which there is plentiful evidence in raised beaches) and how much of it may be due to climatic change. The red sands probably result from a warm moist climate with a long hot season rather than from arid conditions. The sequence is, at any rate, not incompatible with evidence of the climatic changes found in the Vaal River basin.

There is a remarkably widespread discontinuity in soil profiles in different parts of the country: in areas underlain by rocks of the Karroo System the discontinuity generally lies at from one to three feet below the present surface. In other areas the sequence is more variable, though essentially similar. Below the discontinuity the soil is often darker and more humid and appears to represent a fossil top soil of a former land surface. M.S.A. flakes, though rare, occur on the line of the discontinuity and if artefacts are present at lower levels they are of pre-M.S.A. type. L.S.A. tools occur *on* the present surface, but not normally below it. There does not appear to be any general physiographic or tectonic cause of the lithological changes and it may reasonably be inferred that the principal control was climatic. Humic soil underlying the discontinuity is indicative of moist conditions, while calcification or ferrugination of the pebbly surface at the discontinuity points towards an increasing aridity.

Summarising the evidence for climatic changes in South Africa, it must be admitted that it is slender, apart from that provided by the Vaal River deposits. It seems reasonable, however, to accept provisionally that the sequence found here may be extended to the surrounding plateau areas of similar present-day climatic regime (including all the country above 3,500 feet which also has an average rainfall exceeding about 12 inches a year). It would then include much of the Transvaal, most of the Orange Free State and the eastern part of West Griqualand and Bechuanaland. Outside this area independent evidence for climatic changes will have to be sought.

There is some evidence for correlating the 'Younger Pluvial' of the Vaal River basin with the 'Earlier Wet Phase' of the Zambesi: in both areas aeolian red sands cover deposits containing

pre-Abbevillain types of tools and are succeeded by gravel aggradations containing tools of Abbevillian and Acheulian type, and belonging to a wetter period. Rhodesian Stillbay implements occur in deposits of a wet period at the Victoria Falls as they do also in the Vaal River basin. There is thus some reason to equate the Falls ' Later Wet Phase ' with the ' M.S.A. Wet Phase ' of the Union, though the former is apparently more intense than the latter.

It is felt that the limited data at present available do not justify attempts at correlating the climatic oscillations of the region considered above with those of other African areas and certainly not with events in Europe. It appears that the climatic changes which affected this region were of relatively slight intensity and may well be masked by local factors.

III. Coastal Terraces and Raised Beaches

It seems probable that in Miocene times—or even in the early Pliocene—the coastline of South Africa lay somewhere in the neighbourhood of 1,500 feet above its present position. Shelly limestones of Eocene-Miocene age accumulated on a wave-cut surface in the southern coastal region and now lie at elevations not exceeding 1,200 feet above present sea level. It has been shown in Pondoland that three broad terraces occur at 1,500 feet, 1,000 feet and 500 feet, each showing signs of warping after its formation and sloping gently southwards. There is some evidence to show that these terraces extend into Natal and elsewhere in coastal areas of South Africa. They presumably represent resting stages in the general uplift of the sub-continent to its present level during the later Tertiary.

The extensive investigation of A. V. Krige (1927) resulted in the recognition of two main zones of lower raised beaches round the South African coast. These were termed the *Major Emergence*, resulting in broad shelves and strand lines at an average altitude of 60–70 feet above present sea level and a *Minor Emergence* of later date producing smaller shelves at about 20 to 30 feet. Still younger small beaches occur below the 20 foot level, principally at 12 to 15 feet. The Major Emergence beaches show evidence of crustal warping, but there is little distortion of the Minor strand lines.

In addition to these two fairly clearly recognisable zones of raised beaches, there are some relics of marine terraces at heights ranging from 200 to 400 feet above sea level at various points around the coast, but they are too widely scattered and disconnected to be correlated at present.

TABLE I

TENTATIVE CORRELATION OF QUATERNARY EVENTS IN SOUTH AFRICA

PERIOD		CAVE DEPOSITS		OTHER FOSSIL-BEARING DEPOSITS	MARINE EVENTS	RIVER DEPOSITS	CLIMATE IN VAAL RIVER BASIN	CULTURE
HOLOCENE		Coastal Caves Wonderwerk Cave	Border Cave ?Cave of Hearths	Floris Bed Cornelia Beds Vlakkraal	Retreat of sea to present level	Erosion	Semi-arid	WILTON SMITHFIELD
PLEISTOCENE	UPPER				Cutting of lower raised beaches	Calcification		
					Retreat of the sea	Formation of grits	M.S.A. WET PHASE Semi-arid	MIDDLE STONE AGE
					Cutting of 'Minor Emergence' beaches	*Youngest Gravels* of Vaal basin	FAURESMITH WET PHASE	FAURESMITH
					Retreat of the sea and slight crustal warping	Erosion of channels Calcification of sands	Semi-arid to arid	
					Cutting of 'Major Emergence' beaches and caves at about +70 feet	Deposition of sands over gravels		Later STELLENBOSCH
	MIDDLE			Zululand Clays?	Exposure of continental shelf (about —200 feet)	Deposition of *Younger Gravels* of Vaal river. Earlier gravels of Great River Fish etc.	YOUNGER PLUVIAL	Middle
		Gladysvale	MAKAPAN		?Sea level at +200—300 feet			
	LOWER	Kromdraai Schurveberg Later deposit of Plesianthropus Cave (Bolt's Workings)	Upper Buffalo Quarry Lower Buffalo & Upper Limeworks		?Exposure of continental shelf ?	Erosion of channels Wind-blown sand	Arid	Early
				?Taungs?				Pre-Stellenbosch
		Plesianthropus Layer	Middle Limeworks Lower Limeworks					
PLIOCENE	VILLAFRANCHIAN				Final major uplift of sub-continent	Deposition of *Older Gravels* of Vaal river Erosion of main river channels	OLDER PLUVIAL ?Arid ?	

There is abundant proof that at some time the sea stood at least 150 feet *lower* than it now does and at that time at least part of the continental shelf was exposed as dry land. Du Toit, indeed, suggests that much of this broad submarine platform was actually cut during periods of low sea level. Many of the larger rivers entrenched themselves deeply during the low sea level and now display typical characteristics of drowned valleys. There is no clear geological evidence concerning the relative ages of low sea levels and the beach cutting episodes.

Late Stellenbosch tools have been found *on* the broad 70 foot Major Emergence marine-cut platform at Hermanus and elsewhere. Similar tools occur at the Cape in river gravels apparently equivalent in time to this period of terracing, and late Stellenbosch tools are found at several sites down to 20–30 feet above present sea level. It would appear certain that the Major terracing had been completed before the end of the Stellenbosch since the resultant shelf was undoubtedly exposed as a dry land surface in late Stellenbosch times. It is also clear that the Stellenbosch culture persisted for some time after the exposure of this terrace. There is some slight evidence to show that the 25 foot Minor beaches may be partly contemporary with the M.S.A., for Goodwin has remarked that M.S.A. sites near the coast are all situated above the 20 foot level, generally immediately above it, but never below it.

Glacio-eustatic changes of sea level were probably at least partly responsible for the terracing, but in view of the undoubted evidence for actual continental movements during the later Tertiary, it is difficult to know to what extent they were responsible. Zeuner (1942) has suggested that the Major beaches may be of 'Main Monastirian' date and the Minor terraces 'Late Monastirian', since their elevations correspond roughly with those of terraces of these periods elsewhere.

IV. Cave Deposits

Quite a large number of caves are known in which Later Stone Age tools occur in stratified deposits of cave earth and these are sometimes underlain by M.S.A. deposits. Some of the caves, notably those at the Tzitzikama near Port Elizabeth, Matjes River near Kynsna, Oakhurst near George, Fish Hoek near Cape Town and the Border Cave on the Natal-Swaziland border, have yielded human remains, some of them belonging to the M.S.A. and some to the L.S.A. The deposits do not yield acceptable evidence of climatic fluctuations. Earlier Stone Age tools are practically unknown from caves; Fauresmith implements are, however,

found at shallow depth in a cave in the Kuruman district and in 'The Cave of the Hearths' in the Makapan Valley. Other cave deposits at Taungs, Sterkfontein and Kromdraai have yielded valuable mammalian fossils, including remains of the famous Australopithecine group.

The deposit at Taungs differs from the other cave breccias, being composed of tuffaceous deposits filling former stream channels, some sheet limestones, cliff limestones and vlei limestones. A conspicuous feature is the inclusion of bodies of reddish-brown sand, the largest of which obviously represent infillings of former caves or passages in the limestone. The fossils were recovered from sandy limestone which cannot differ greatly in age from the main body of the limestone as a whole. Both geological and palaeontological evidence are in accord in indicating an arid environment for the filling of the caves, very possibly even more arid than the existing climate of this dry area.

As a result of recent conclusions regarding the development of the Vaal River and its deposits, it is now possible to suggest a probable limiting age for the Taungs limestones. At the time of commencement of the formation of the Older Gravels, the Hartz River (and its tributary the Buxton) must have been flowing over a surface at least 350 and possibly 400 feet above its present bed. At this time the cliff from which the Taungs limestone grew could not have been exposed very long. Since the Older Gravels belong to a more humid cycle and the limestones to a relatively drier period than that of the present day, the Taungs limestones must belong to a dry period preceding or just following the Older Pluvial of the Vaal. On Broom's fossil interpretation the former is the more probable alternative, but purely geological evidence favours the latter view.

The Transvaal caves occur in pre-Cambrian dolomitic limestones, owing their origin to solution of the limestone by meteoric waters. A few of them contain bone-breccias, though it is not to be expected that all are of precisely the same age. Erosion has been sufficiently extensive to remove the cave roofs in many cases and even to erode the breccias themselves. The principal breccia sites are not far from the margins of the Vaal River basin and it may be inferred that most of them antedate the Younger Pluvial of the Vaal since no subsequent cycle seems to have had sufficient erosive activity to effect the denudation which has actually occurred. The formation of the redder breccias seems to represent somewhat drier conditions than those of the present day with rather stronger winds carrying larger grains of sand than could be borne by winds

of our present climatic cycle. It may be inferred that during the drier periods the Kalahari extended further eastwards than its existing limits. At certain horizons and in some localities the colour is somewhat browner and travertines or marls occur occasionally, indicating moister conditions of deposition. The principal braccia localities are near Krugersdorp, embracing the numerous deposits near Sterkfontein, at Kromdraai and Gladysvale (Uitkomst), at Schurveberg near Pretoria and in the Makapan valley north of Potgietersrust some hundred and fifty miles north of the Pretoria-Krugersdorp group.

V. Quarternary Mammals

The most peculiar fauna of direct interest in Quaternary studies is that of Taungs, from which site Dart described *Australopithecus africanus*. The commonest associated fossil is the baboon *Parapapio africanus* (Gear). A rodent mole *Gypsorhychus darti* and a rock rat *Petromys* (*Palaeopetromys*) *minor* are considered by Broom to indicate arid conditions, probably with a rainfall of less than six inches a year. This fact, rather than its greater age, may account for the difference between this fauna and that of the Transvaal limestone caves.

The Makapan Valley was first examined by Dart in 1925, but no fossil material was described from the area until Broom's account in 1937 of a dwarf buffalo *Bos makapaani* from a cave now known as Buffalo Cave.

On the percentages of extinct and living forms and the number of identical species present in the lower, middle and upper zones of the Limeworks Quarry, it is clear that there is no very great difference in age between these zones. Five species are recognised in the lower zone of Buffalo Cave of which three are known from the lower or upper Limeworks. The upper zone contains fifteen species of which eight are not recorded from the Limeworks deposits. The assemblage from the upper zone of Buffalo Cave resembles amazingly that of the Younger Gravels of the Vaal and there can be little doubt that the two are not widely separated in age. It also appears certain that the upper zone of Buffalo Cave represents a more recent stage than any part of the Limeworks deposits.

In the Krugersdorp-Pretoria group of breccias the oldest appears to be the ' Plesianthropus layer ' of the cave which yielded *Plesianthropus transvaalensis* (Broom). This layer is linked to the lower zone of the Makapan Limeworks by a baboon *Parapapio broomi* Jones and is probably of much the same age. Broom has

recently reported a primitive type of hyaena *Lycyaena silbergi* from this layer and suggests that this Lower Pliocene genus indicates great antiquity. There are now so many instances of 'holdover' species or genera in Pleistocene deposits throughout Africa, however, that this cannot be allowed to weigh very heavily against other and contrary evidence.

The later deposit of the Plesianthropus cave has furnished a rather different fauna from that of the Plesianthropus layer, though there is no clear indication of any major stratigraphic break. *Parapapio whitei, Elephantulus langi* (a shrew) and *Cryptomys robertsi* (a rodent) connect this deposit with the breccias of Bolt's Workings a mile away. Bolt's Workings, in turn, are linked to the Buffalo Quarry at Makapan by the pig *Tapinochoerus meadowsi,* also occurring in the Younger Gravels of the Vaal. *Procavia obermeyerae* is also suspected to be represented from the upper zone of the Makapan Limeworks, thus providing a further connection between these two areas. The occurrence at Kromdraai of this species, together with *Crossarchus transvaalensis* both here and at Bolt's Workings indicate that Kromdraai is of the same general age. The presumed relative correlation of these sites is shown in the accompanying Table.

The fauna of the Vaal River gravels has been the subject of sporadic description of new species for many years, but no assemblage of forms from a single site was described until 1939 by the present writer. The commonest fossil is *Hippopotamus amphibius;* others include *Equus capensis* Broom, *Equus kuhni* Broom, *Equus burchellii* Gray and, less commonly, *Equus plicatus* (van Hoepen), *E. sandwithi* Haughton, *E. harrisi* Broom, *Phacochoerus africanus* (Gmelin), *Peloroceras helmei* (Lyle) and *Damaliscus* sp. Forms known only from the Vaal River include the pigs *Mesochoerus paiceae* (Broom), *Notochoerus capensis* Broom and *Phacochoerus altidens* Shaw and Cooke, a new species of *Griquatherium* (the original *G. cingulatum* Haughton now being known also from the Makapan Valley), a new special of *Peloroceras*, a new large *Alcelaphus*, a new *Gazella* and several Proboscidea, ranging from primitive to advanced types.

The presence of a number of advanced horses, highly developed pigs and an advanced elephant in certain association with the middle phase of the gravels, together with a fair number of living species (particularly of Bovidae), seems to suggest a generally Middle Pleistocene evolutionary stage. The deposits probably range through most of the Middle into the Upper Pleistocene.

Only one good assemblage of fossils belonging to the post-

Younger Gravels has so far been found in certain association with implements solely of the M.S.A. This comes from a deposit of sands and clays round the 'eye' of a thermal spring at Vlakkraal some twenty five miles from Bloemfontein and five miles south of the well-known curative springs of Floris Bad. One third of the species appear to be extinct forms. The assemblage has the aspect of the fauna of the modern high-veld but is richer in the possession of certain large extinct species, notably *Equus capensis*, *Bubalus bainii*, *Peloroceras helmei*, *Phacochoerus compactus* and *P. helmei* which may be inferred to be survivors from the earlier fauna since all are represented in the Younger Gravels of the Vaal.

Fauna from the nearby Floris Bad (or Hagenstad) includes in addition to the above *Connochaetes antiquus*, '*Kobus*' *venterae*, *Aonyx robustus*, and *Pedetes Hagenstadi*. Implements earlier than the M.S.A. occur and, while these species might be contemporary only with the earlier industry, they are more likely to be 'missing elements' in the Vlakkraal assemblage. It has been suggested that since extinct forms survive into the M.S.A. while none are known in association with the Later Stone Age, the break between these two cultural groups may mark the end of the Pleistocene in South Africa. The Later Stone Age with its impoverished fauna would accordingly be regarded as falling within the Holocene.

Other sites yielding faunal remains include the Wonderwerk Cave in the Kuruman district, where the fossils are associated with implements ranging from the Fauresmith to the L.S.A.; in the neighbourhood of Cornelia in the northern Orange Free State, where the fauna resembles that of the Vaal River and Floris Bad; at Bankies near Kroomstead, where both the geological horizon and the faunal assemblage suggest that it belongs to the M.S.A. period; in coastal caves, where *Equus capensis* is associated with a Still Bay culture; in the Border Cave on the Swaziland-Natal boundary, where M.S.A. cultures and human remains are found together with the extinct *Equus kubni* as well as living species. In addition to these, a number of type specimens come from scattered sites of uncertain geological relationships and ages.

There is a certain resemblance between the faunas of the South African region and those of East Africa. The Oldoway assemblage is strikingly similar to that of the Younger Gravels of the Vaal. Some of the more primitive species from the Vaal resemble forms from the Omo beds, and the Omo Bovidae and Suidae suggest comparison also with the Limeworks deposit of the Makapan Valley.

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PLEISTOCENE CLIMATIC PHASES IN CEYLON

P. E. P. DERANIYAGALA

The island of Ceylon retains living African animals that do not occur elsewhere. Another peculiarity is that the Palaeolithic hand-axe that ranges from Africa to eastern Asia does not exist in Ceylon, although pebble, flake and core stone artefacts akin to some of the oldest types from Africa occur in the gem sands of Ceylon. Thus this island would appear to be a backwater where some Stone Age cultures escaped submergence by others.

The gem sands which lie at 4 to 9 metres beneath the surface, appear to have been deposited at intervals during Holocene, Pleistocene and possibly Pliocene times. The artefacts contained in them might result from redeposition mixing them with earlier pre-human fossils ; on the other hand they might have existed in beds containing such fossils and been re-deposited together with younger ones. The older of Ceylon's two cultural phases is well represented in the gem sands : it is a crude flake-chopper industry known as the *Ratnapura* culture. The younger or *Balangoda* industry is comprised of pitted, ground and polished artefacts found in association with microliths of quartz and chert in cave floors at a depth of about 30 cm. from the surface, but also to a lesser extent in the gem sands. It would appear, therefore, that there were several periods of deposition ; this evidence is supported by the fact that there is a repetition of leaf beds and gem sands.

Some insight into the climatic phases which prevailed can be

gained from the following data concerning the gem sands and the beds immediately above them :

1. The gem sands of the youngest river terrace are seldom or never laterised, whereas in the higher terraces they usually are.

2. Repetition of layers of gem sands and leaf beds, usually two or three in number but sometimes four or more, reveal that the lowest layer of gem sand is invariably the thickest.

3. Large water-worn boulders in the sand indicate torrential river action.

4. Hippopotamus fossils in the gem sands indicate extensive rivers and lakes. Fossils in beds only 15 cms. to 60 cms. thick are equivalent to those in the Sivalik succession in beds many thousands of feet apart.

5. Subfossil rushes above the fossils mentioned in (4) suggest slower flowing water.

6. Variegated beds above the gem sands suggest deposition in lakes with shifting currents.

7. The presence of red and yellow beds above the gem sands indicate arid or warm conditions.

8. Upon the coastal plain a layer of irregular quartz fragments ranging in size from a man's fist to less is found about 30 to 80 cms. beneath the surface. This layer would appear to be the result of a pluvial phase which also spread river sand over the coastal area, where many of the rocks contain large pot-holes. These are now remote from rivers, but show that rivers must have flowed over them in former times.

A tentative reconstruction from the above data indicates two or three recurring climatic cycles, the latter of these being less marked than the earlier. The phases in each cycle consist of :

1. Torrential rivers.
2. Slow rivers.
3. Lakes.
4. Swamps.
5. Dry land.

To-day Ceylon possesses no natural lakes, but swamps abound and contain most of the gem pits. Correlation with such lakeless swamp areas in Africa should throw considerable light on the age and progress of fossilization of animals and on human artefacts.

THE PLEISTOCENE MAMMAL FAUNAS OF PALESTINE AND EAST AFRICA

D. M. A. Bate

A study of the Palestine cave faunas has shown Asiatic influences to be predominant, with an occasional definite immigration. Nevertheless, an African element, often slight, may also be discerned, and in examining any group or species from Palestine comparison with African forms can never be neglected.

There are no Pleistocene mammal records from Transjordan, Iraq, Persia nor Arabia on the Asiatic side, while in Africa little is known from Egypt, the Sudan, Abyssinia and Somaliland. This is especially to be regretted since these countries must have formed at least part of the great migration routes between Africa and Asia, and Asia and Africa. Although lying rather to the north of the main thoroughfare, Palestine has, throughout the Pleistocene, been affected by migrations from Asia to East Africa. Furthermore, the North African coastal area has received a number of northern immigrants from Palestine, such as bears and voles.

In Palestine the fauna from the Bethlehem beds, with *Hipparion* and early elephants, is considerably older than any known from the caves. It has not yet been studied in detail, but it will probably be found to be correlated faunistically with that of the early part of Oldoway Bed I, or perhaps even earlier.

The oldest of the Palestine cave faunas, known chiefly from the earliest levels, F and E of Tabun, was associated with an Upper Acheulian industry, and gives evidence of a warm, damp, possibly tropical climate. Practically all forms prove to be extinct species, and two extinct genera are present. The general aspect is Asiatic, but a few species show possible connections with Africa: these include an extinct pheasant *Phasianus hermonis*, a large carniverous bat (*Megaderma watwat*) a rat (*Arvicanthis ectos*) and a small rat (*Mastomys*). This fauna is probably subsequent to Oldoway Bed III.

In slightly later levels (Tabun D and C) associated with a Lower Levalloiso-Mousterian industry and with a a somewhat drier climate, but with permanent water, the fauna is more predominantly Eurasiatic, but also includes Hippopotamus, crocodile and river turtle (*Trionyx*). The fauna of Skuhl cave, which is thought to belong to the latter part of this time, has provided an outstanding species in *Phacochoerus garrodae*, a small wart hog, the only one known outside Africa. Highly evolved types of *Phacoc-*

hoerus molars are known from Bed IV of Oldoway, that is before the faunal change which took place after Bed IV times. This may be correlated faunistically with a similar change which took place in Palestine between Lower and Upper Levalloiso-Mousterian times. Subsequent to this faunal change the mammalian fauna of both East Africa and Palestine were of modern type with few survivals from earlier times. The entirely Eurasiatic character of the Palestine fauna gives the impression that communication with Africa had been severed at the time of the faunal change. At this time the Palestine mammals were almost all extinct species.

The Natufian (Mesolithic) mammal fauna of Palestine provided a surprise, since it was found to be quite distinct from that of the present day, although the presence of a domestic dog attests its comparatively recent date. The antelopes are of extreme interest for they are quite unrelated to any Recent Asiatic forms. They are extinct species, different from, but related to, modern African types, such as Grant's gazelle and others. This suggests inevitably that these two groups belong to a single wave of migration from Asia, the African species alone surviving to the present day

To-day Africa is characterised by a wonderful abundance of antelopine forms, while in Asia this is an impoverished group. It has only recently been learnt that in earlier days, at least to the close of Villafranchian times, Asia harboured antelopes in astonishing numbers and variety, and has doubtless provided Africa with antelopine immigrants not only in Pliocene, but in more recent times.

The study of the Pleistocene faunas of Palestine must always be of importance to our knowledge of African faunas, for Palestine should supply a key to the dating and composition of the mammal migrations between Asia and Africa.

THE RED BEDS OF THE MEDITERRANEAN BASIN

C. Arambourg

I have on several occasions indicated that the Red Beds of the North African littoral may serve as a stratigraphic mark. Now, I wish to develop this idea and show their use in other Mediterranean areas.

I. The Nature of the Red Beds

The Red Beds consist of eluvial formations of argillaceous sands associated with breccias. Their origin is due to stream

action and decalcification of neighbouring limestone blocks. Their red colour implies temperate conditions and rainfall very different from those of to-day.

These deposits form thick coverings on plateaux and at the base of slopes where they have accumulated. They are also to be found in caves, and in certain cases, their continuity there with the red beds outside can be observed.

Whenever it is possible to ascertain their stratigraphical relationship, it is seen that they are later than the last marine terrace whose upper surface lies at the 15–18 metre level. In various places in the North African littoral they contain human industries and fossil fauna. The industry belongs to the middle Palaeolithic (Levallois-Mousterian) with quartzite artefacts. The fauna, in North Africa, is characterised by the presence of *Hippopotamus amphibius* and immigrated species of arctic character : *Rhinoceros Mercki*, Cervidae, bears, etc.

II. Geographical Distribution

The Red Beds are found all over the Barbary littoral from the Atlantic coast at Rio de Oro to Tunisia and are seen again on the coasts of Palestine, Lebanon and Syria.

1. *Vicinity of Oran*—Karouba Section

This classic section in the sea cliffs 4 Km. north of Mostaganem has been studied by Pallary (1891) and Doumergue (1922). It is a marine terrace of sandstone and conglomerate containing *Pentunculus*, *Cardium*, *Pecten*, whose upper surface attains 18 metres near the coast. It is gullied and filled by a bed of about 1 metre thickness of red sands formed by water action,which contain a fine industry with large Levallois flakes. These sands are overlain by a bed 1 metre thick of yellow aeolian sand and finally by a consolidated dune.

In this region the beaches and littorals of the 18 metre level are almost continuous, especially round the Mostaganem-Arzew gulf. They are generally rich in marine fossils and contain, especially near Arzew, *Strombus bubonius*. Above these marine deposits are eluvial red sands containing land molluscs (*Helix* and *Bulinus*) corresponding to the red sands containing worked quartzites at Karouba. They are again overlain by a consolidated dune (Fig. 1).

The formation of red sands is known to Algerian geologists as the 'Hélices sandstone.'

2. *Algerian Region*

In Western Algeria a second example of this succession is to

be found on the coast between Casiglione and Tipaza. Near the village of Bérard the shelly conglomerates are only 5 metres above

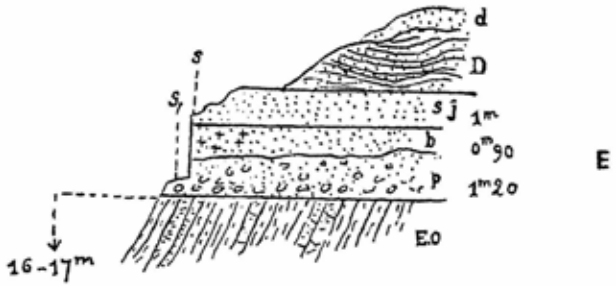

Fig. 1. Section of the Karouba site (Doumergue, 1922). Eo, Upper Eocene ; P, marine conglomerate and sandstone ; Sj, yellowish sands ; D recent consolidated dunes ; d, contemporary dunes ; ++, quartzite ; s_1, lower path ; S, upper path.

sea level. They are overlain by red sands containing land molluscs, artefacts of quartzite and flint, and traces of hearths. A little further on, near the farm of Beauséjour, is a similar section where the tooth of a dwarf elephant, described by Pomel as *E. iolensis*, was found in the red sands. This tooth resembles those of *E. melitensis* of Malta (Fig. 2).

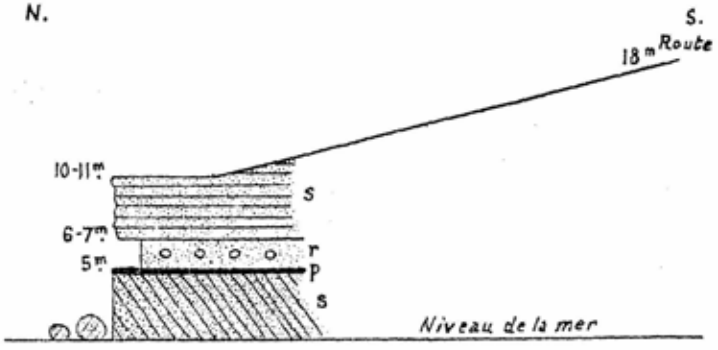

Fig. 2. Section of the cliff at Bérard (Lamothe, 1911). S, ancient aeolian sandstone ; P, shelly conglomerate ; r, red sands ; S, sandstone containing *Helix*.

Nearer Algiers, between Guyotville and the ancient massif of Bouzarea, are a whole series of caves at 15 metres in the blue carboniferous limestone. The off-shore sand bar (' *cordon littoral* ') containing marine fauna penetrates them and forms a floor on which rests a thick filling of red clay rich in fossil bones. An industry of Mousterian type has also been found here. The cave fauna is characterised by *Hippopotamus amphibius*, *Rhinoceros mercki*, *Ursus larteti*, *Megaceroides algericus*, etc.

Near Guyotville two other caves yield a similar and abundant fauna contained in red clay which is covered by a consolidated dune rich in land molluscs (*Helix* and *Bulinus*). The dune corresponds to the Hélices sandstone near Mostaganem ; it here plunges straight into the sea and is evidence of a drowned coastline and was evidently formed during a period of marine regression after the transgression of 15 metres.

In one of these caves the fauna is associated with hearths and a large, coarse industry of Mousterian-like flakes, all resting on sands and marine conglomerates containing shells which fill the cave to nearly 15 metres. This last section is therefore very interesting as it shows that the deposit containing *Rhinoceros mercki,* Hippopotamus, and middle Palaeolithic industries is (*a*) above the lower marine beach as in the preceding sections, and (*b*) formed during the great regression which followed the formation of this beach and which corresponds to the last glacial period. Out of the whole Algerian littoral, the fauna and industries characteristic of the red beds can best be dated here (Fig. 3).

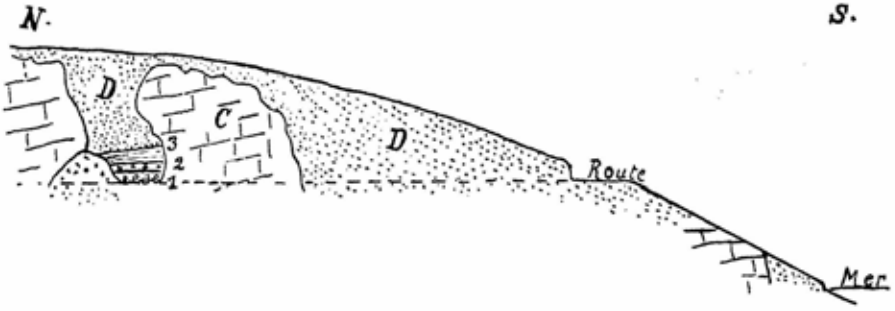

Fig. 3. Littoral section of the Anglade quarry at Guyotville (Arambourg 1935). C, Palaeozoic limestone ; D, consolidated dune ; 1, conglomerate containing marine fauna (15 m. level) ; 2, ash and hearths containing hippopotamus, *Rhinoceros mercki*, and an industry ; 3, red clays and sands.

The red sands, still associated with the lower marine terrace which they cover, continue eastwards beyond Algeria. Various authors (Piroutet, Gaucher, Marchand) have noted this association and described in the red sands at Cap Motijou, at Ain Taya and beyond, various sites containing worked flints and quartzites similar to those at Karouba.

3. *Morocco*

Although here the Quaternary stratigraphy of the littoral is more complex than in Algeria, one finds nevertheless along the

whole Atlantic coast from Agadir as far as Rabat and beyond, red beds, superimposed on Quaternary marine or dune formations. Flints of Mousterian type have been found at certain points, and the fauna is characterised by *Hippopotamus amphibius*, and *Rhinoceros mercki*.

4. *The coasts of the Levant*

The same association of red beds lying on the lowest marine terrace continues on the coasts of the Levant from Palestine to Alaouite. In Palestine Miss Garrod and Miss Gardner (1935) noticed a Mousterian industry at Mount Carmel in red beds overlying consolidated dune.

The coasts of Syria and Lebanon afford special facilities for studying the association of marine beaches and consolidated dunes as well as eluvial formations containing human industries *in situ*.

On the Beyrouth promontory and its immediate surroundings red argillaceous sands overlie great extensions of consolidated dunes strongly cemented (here known as ' Ramleh ' and used for building stone). The red sands contain an industry of late Levallois type (according to P. Fleisch). Continuing northwards along the Lebanon-Syrian coast, although the details seem more complex than near Beyrouth, and the interpretations of various authors do not always agree, one finds nevertheless the same association of sand bars, consolidated dunes and red beds containing Levallois-Mousterian industries. At several localities the lower sand bars contain fauna characterised by *Strombus bubonus* and a Levallois industry identical with that at the beach of St.-Elie. (Fig. 4).

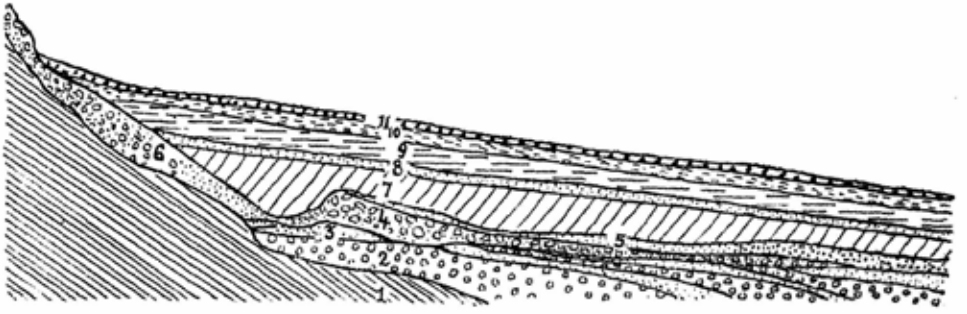

Fig. 4. Cement quarry at Chekka (Wetzel and Haller, 1945). 1, marly substratum ; 2, beach sandstone leaning against the rocky slope at 14.50 metres ; 3, thin fragments of dune ramleh ; 4, marine conglomerate (*cordon littoral*) ; 5, sandy concretions, Levallois industry ; 6, silts of the slope, Mousterian industry ; 7, brown clay, Mousterian industry ; 8, gravel, Upper Palaeolithic and Mousterian industries ; 9 to 11, black earth, soils, etc., recent industries.

Conclusions

1. In the whole of the Mediterranean littoral the red beds above the Monasterian marine terrace contain Levallois-Mousterian industries.

2. They were formed during the great marine regression which occurred after the formation of this terrace, *i.e.* contemporaneously with the Würm glaciation.

3. Their fauna is characterised in North Africa by the persistence of ancient African elements such as *Hippopotamus amphibius*, *Elephas* (*Loxodonta*) *atlanticus*, and by the appearance of new elements from Eurasia : *Rhinoceros mercki*, *Elephas* (*Palaeoloxodon*) *iolensis* (= *melitensis* ?), *Ursus larteti*, Cervidae, etc.

In Palestine Miss Garrod and Miss Bate (1939) noted also the appearance during the Mousterian of an Eurastiatic type of fauna, succeeding the types with *Hippopotamus amphibius* which prevailed before.

4. These faunal changes, as well as the nature and disposition of the red beds, are related to profound climatic changes. They appear to correspond to a hot and very wet climate, and great pluvial deposits have accumulated at the base of slopes and on plateaux, filling up depressions with products caused by the washing and decalcification of neighbouring limestone masses.

The above seems to apply equally in its main features to a large part of the Mediterranean basin, Italy, Sicily, the coast of Provence, etc., where the formation of red beds marks—as in N. Africa—a climatic episode corresponding both chronologically and causally to the great Würm extension of the European glaciers.

PLEISTOCENE CLIMATIC CHANGES IN EAST AFRICA

E. Nilsson

Ancient climatic changes have left their most convincing traces in East Africa. On its high mountains series of terminal moraines indicate the former extension of glaciers or mark their halts when retreating. And in the basins of the Rift Valley, high above the present small lakes without outlets, may be seen beaches and sediments of former large lakes.

I. Evidence from Moraines

Moraine ridges may be seen on the slopes of Mount Kenya far below the present glaciers. Marked ridges of terminal moraines are grouped along the sides and in front of the valleys : they look very fresh, as if they had been newly made. (Fig. 1). Below these ridges, which I refer to the Last Pluvial, lies older morainic material in irregular hills evidently dissected by meltwater streams of the Last Pluvial.

Two similar series of moraines exist in the Highlands of Semien in the northernmost part of the Abyssinian plateau. The older moraine covers a very much larger area than the younger. (Fig. 2). It is moreover so consolidated that it forms pinnacles in the numerous ravines of the Meshaha River and its tributaries. These two series of moraines I refer to the Kamasian Pluvial and the Gamblian or Last Pluvial respectively.

The map of the summit of Mount Elgon (Fig. 3) shows a typical East African mountain glaciation. From the rim of the crater the glaciers flowed down the valleys as the moraine ridges indicate. The greatest of the moraine ridges lies on the bottom of the crater and is more than two miles in length.

II. Evidence from Lake Terraces

Within the basins of Lakes Naivasha, Nakuru, Hannington and Baringo in Kenya and in the Zwai-Shala and Tana basins in Abyssinia, I have traced and levelled a great number of ancient beaches, all of them belonging to the Last Pluvial. One of the best developed beaches is situated west of Lake Nakuru. This terrace is cut into Kamasian lake sediments. As a rule the beaches are not so distinct, but are often destroyed by erosion or are concealed by aeolian material.

Just as two different series of moraines may be distinguished on the mountains, so there are also at least two series of ancient lake sediments in this part of the Rift Valley. The older or Kamasian sediment is rather consolidated and was laid down in mighty

layers in large lakes during the Kamasian Pluvial. It was subjected to very considerable dislocations during the following interpluvial epoch, which is characterised by lively volcanic activity, and at which time the eastern Rift Valley was apparently largely formed.

In Abyssinia these dislocations seem to have continued also during the first wet sub-epoch of the Last Pluvial and to that time, I think, may be assigned a raised beach which I have traced along the northern base of the Somaliland Plateau and also at the base of the Abyssinian Plateau at Modjo, not far from Addis Ababa. The altitude of the Modjo beach is about 1,800 metres above sea level. On the Abyssinian Plateau I discovered too in several places a sediment very similar to the Kamasian. A complete sequence of this sediment was found near the village of Yaya and I have accordingly given this name to the corresponding ancient lake of the plateau (Fig. 4). This lake must have been very extensive though its actual dimensions are of course unknown, neither do I know where it had its outlet. Lake Yaya seems to have been about seven or eight times as large as Lake Tana though.

The altitudes of areas of Yaya sediment increase regularly towards the south east and indicate a tilting of the Abyssinian Plateau towards the north west. The tilting, along the line drawn in Fig. 4 between Modjo and Dangila, amounts to about 6 metres per kilometre. The position of the raised beach at Modjo would require a corresponding upheaval of the south-eastern corner of the plateau and the north west corner of the Somaliland Plateau, which was tilted towards the Indian Ocean. The plateaux are assumed to have moved as solid blocks.

The lower section in Fig. 4 shows that, before tilting, Lake Yaya stood at about 1,700 metres above the sea, which was at that time at Modjo beach. Lake Yaya must, of course, be older than the tilting and, owing to the similarity between its sediment and the Kamasian, I have earlier referred this lake to the Kamasian Pluvial. I now think, however, that it is necessary to date it back to an earlier pluvial : the Kafuan Pluvial, traced in Uganda by Mr. Wayland.

Similarly the erosion of the enormous valleys and ravines of the Blue Nile and its tributaries requires a longer time and more powerful agents than the Last Pluvial could afford, while observations on East African mountains also indicate that most of the erosive work which carved out their valleys must have taken place during the Kamasian Pluvial or even earlier.

Returning to the ancient lakes in the Kenya Rift Valley, (Fig. 5) shows the levels of lakes in the Nakuru basin belonging to the Last Pluvial. Each point marks a levelled beach. A similar

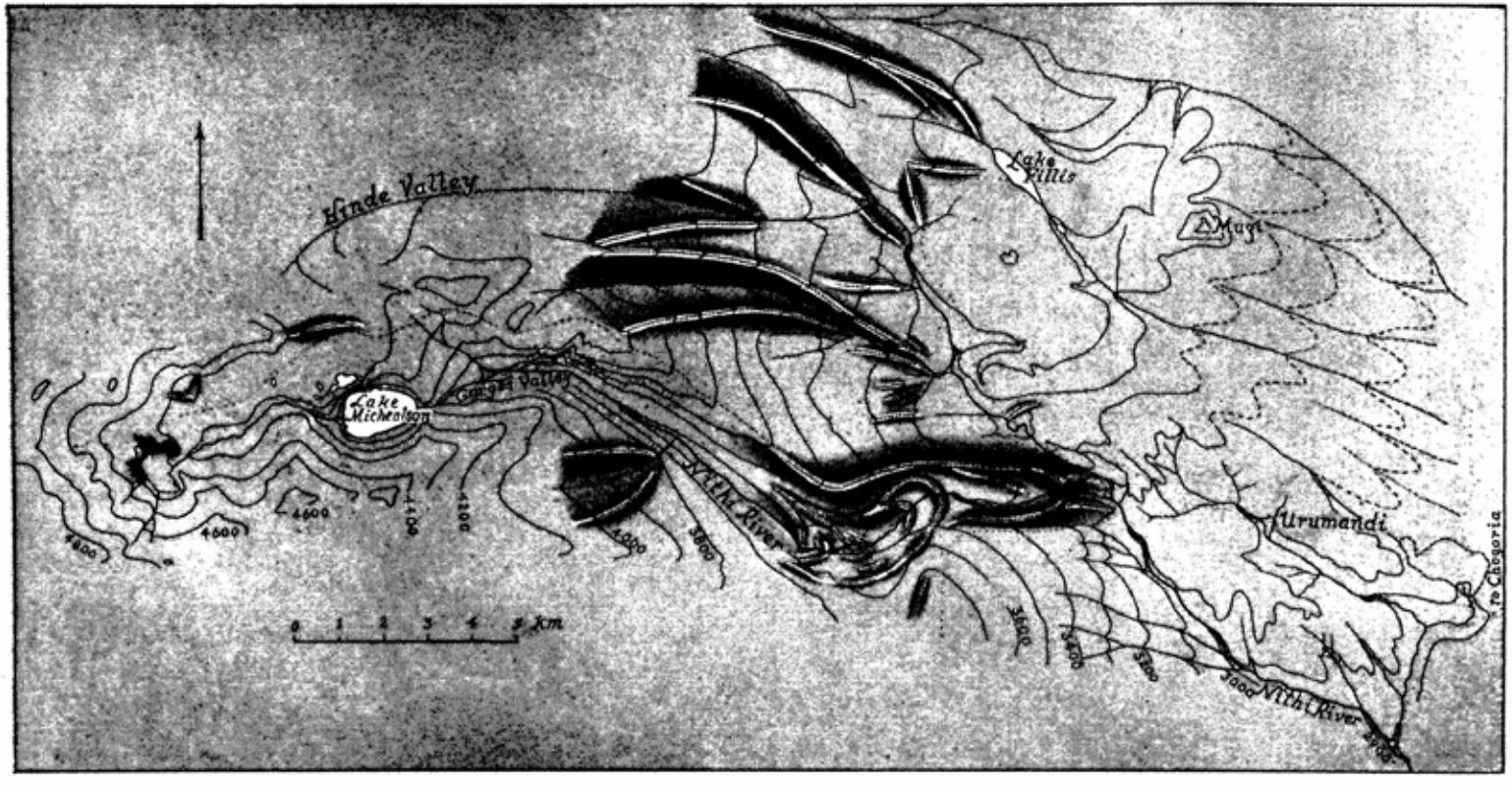

Fig. 1. Sketch-map of the eastern slopes of the Alpine region of Mount Kenya. Mighty moraine-ridges, several kilometres in length, mark different stages of the glaciers of the Last Pluvial. Below these imposing ridges there extends a zone of irregular hills built up of older moraine-material belonging to the Kamasian Pluvial. The height-figures of the contour lines are in metres.

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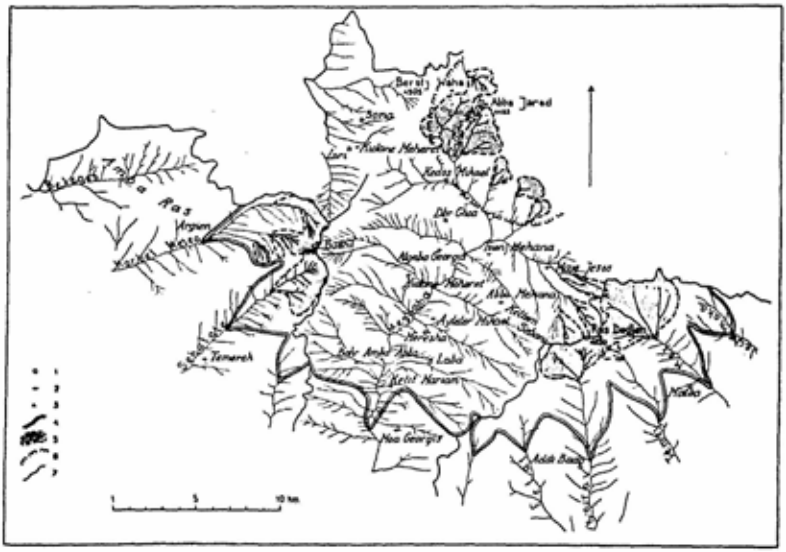

Fig. 2. Ancient glaciation on the Highlands of Semien. (1) Village, (2) Church, (3) Peak (altitude determinated trigonometrically), (4) Approximate limit of the glaciation of the Kamasian Pluvial, (5) Limit of the glaciers of the Last Pluvial, (6) Limit of the centre of the giant volcano of Semien, (7) Precipice. The height-figures are in metres.

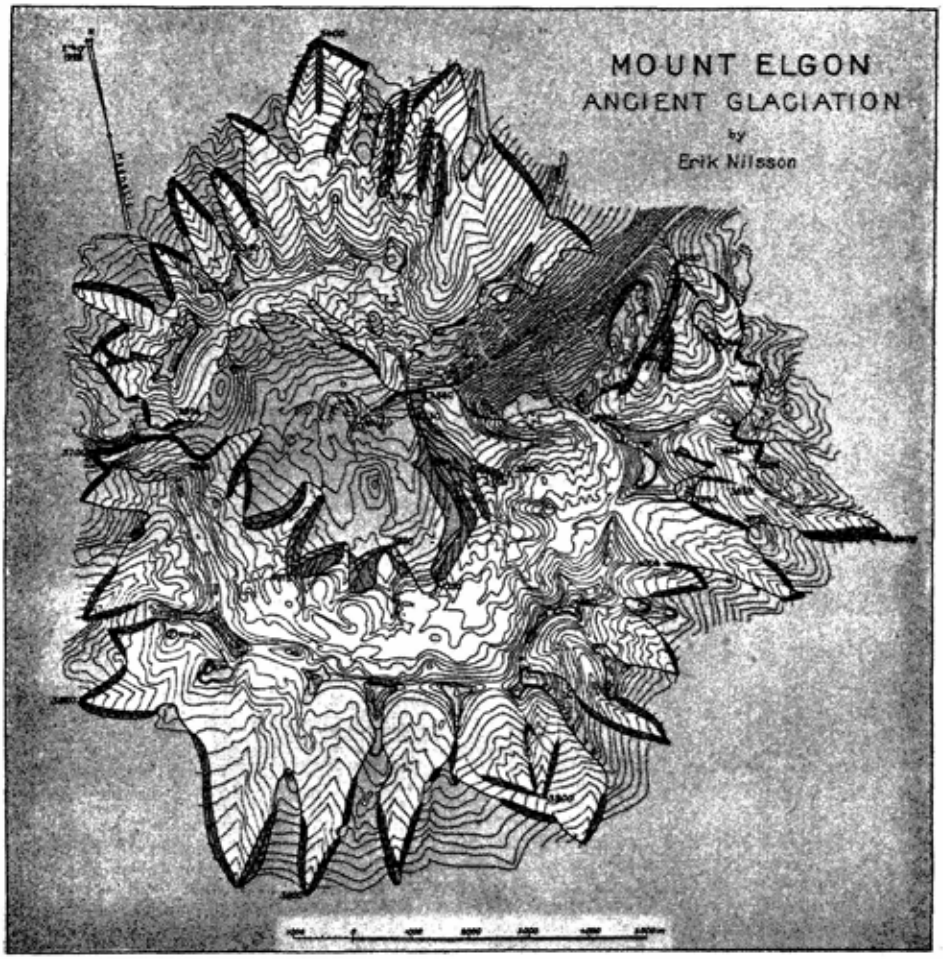

Fig. 3. Mount Elgon. In the Alpine region of the mountain moraine-ridges mark the maximum extension of an ancient glaciation (white areas), typical of the high mountains of East Africa.

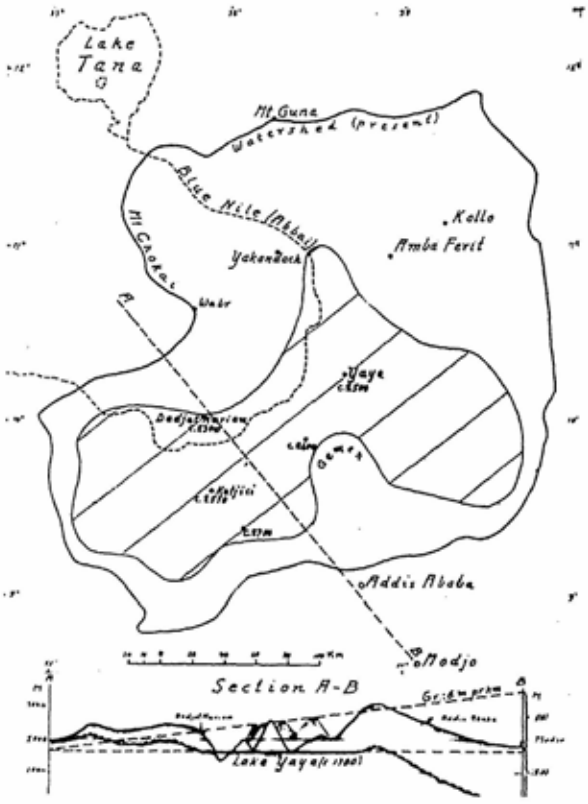

Fig. 4. Lake Yaya (the extension of the ancient lake is very approximate). Below, diagrammatic sections of the Abyssinian Plateau along a line from Modjo to Dangila, showing the height-position of the plateau before and after its tilting towards NW. Lake Yaya probably lay about 1700 m. above the sea level when it stood at the Modjo beach. After the tilting of the plateau the sediments of Lake Yaya are found at altitudes marked with crosses and the Modjo beach lies about 1800 m. above the sea level. The tilting seems to cease at about a line of dislocation between the Rivers Fatam and Bir in a supposed branch of the Rift Valley.

sequence of lake levels may be traced within the Naivasha basin. Volcanic activity continued in these basins during the Last Pluvial and only the youngest of the beaches seems not to have been tilted. An explanation of the fact that lake levels are tilted towards the

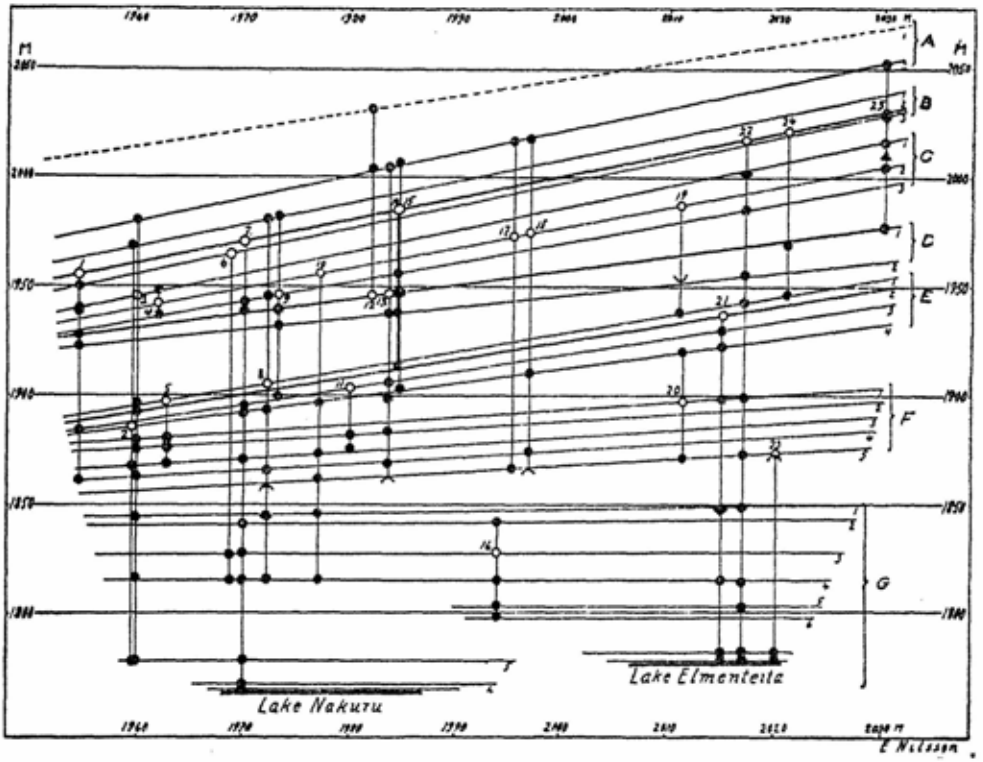

Fig 5. Diagram of ancient beaches of the Nakuru basin. Groups of shore-lines are designated by letters A-G. Terraces are marked by points, barriers by bows and deltas by filled triangles. The triangle of the vertical No. 25 indicates the situation of the pass point at Gilgil.

north in the Nakuru basin and towards the south in the Naivasha basin might be that the Eburu mountain ridge was rising relatively to surrounding parts of the Rift Valley during this period of dislocation.

The highest of the lakes were common to the two basins and had their outlet through Njorowa Gorge. The filled triangle in the diagram marks the height position of the threshold between the basins at Gilgil. When precipitation was not sufficient to fill the Nakuru basin, its lakes sank below this threshold, while the contemporaneous lakes in the Naivasha basin still had their outlet through Njorowa Gorge.

The lakes of the Last Pluvial are divided into groups A, B, C, etc., owing to differences in their sediment, varying amount of tilting of their shore-lines and so on. Fig. 6 illustrates the variations in height of the levels of the ancient lakes in the Nakuru basin.

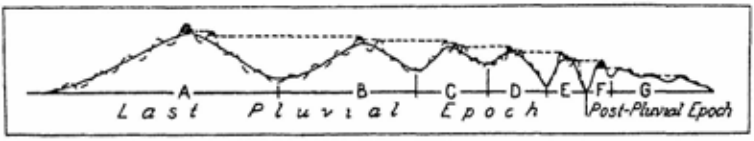

Fig. 6. Variations in height of the level of the ancient lakes in the Nakuru basin. The main changes of this level represent the groups A-G, while the different beaches within each group (A_1, A_2, B_1, B_2, etc.) register such variations of a second order.

The main changes of this level are represented in the groups A—G, while the different beaches within each group register such variations of a second order; there is no time scale. The shore-lines of the highest lake A differ very much from those of the subsequent lakes owing to its much more advanced stage of destruction by erosion. Its sediment also has quite a different structure and colour, being rich red while the younger sediments are often grey. The older sediment consists of a series of thick, regular layers and seems to have been deposited in a lake which was fed abundantly by mighty streams loaded with enormous quantities of gravel, sand and silt. The younger sediments, on the other hand, are seldom of any great thickness.

The skull and horn cores of a fossil water buffalo was discovered in the varved sediment of Lake D2 near Melawa River in the Naivasha basin. The water buffalo had a horn span of 100 inches and its presence indicates a wet climate at that time.

In the section of Gambles' cave shown in Fig. 7, the two layers numbered 9 and 4 indicate desert conditions before and after the Makalian sub-epoch. By comparing diagrams of lake levels in the investigated basins I noticed that the differences in height between two successive lakes vary throughout the diagrams in a very similar way, especially in the case of the younger of these levels. The curves in Fig. 8 show the gradual lowering of the ancient lakes within the investigated basins of East Africa and in the Faiyum Depression in Egypt. The curves are built up from the altitudes of lakes A1 to G6 marked on equidistant verticals. The beach heights in the Nakuru and Naivasha basins have been measured near the centres of the diagrams of these basins. As lake A1 was common to both these basins, the curves in this case start from the same vertical.

Observations at the present lakes Nakuru and Shala show that a

comparatively recent beach in each area at altitudes of 1,767 and 1,571 metres respectively must be contemporaneous, as each marks the limit up to which living acacias have a stem diameter of 20 centimetres but not more. Below these beaches the stem diameters become progressively smaller towards present high water level.

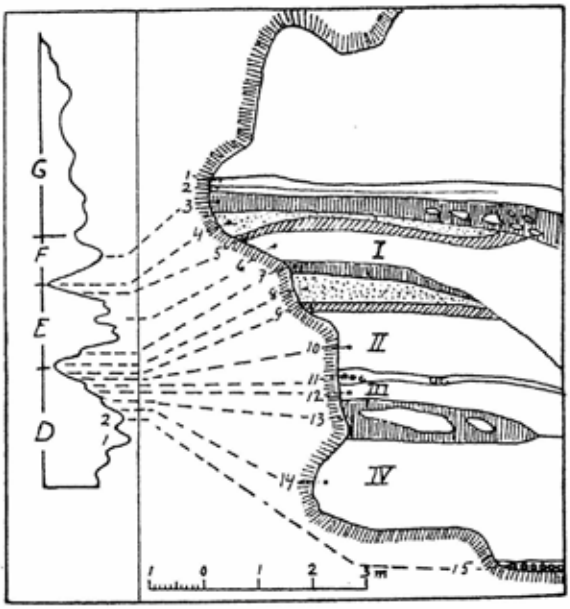

Fig. 7. Section of Gamble's Cave II (according to L. S. B. Leakey) and, to the left, a schematic curve (part of that of Fig. 6) showing the variations in the height of the ancient lakes D-G. A close correlative agreement seems to have existed between the climatical and the archaeological conditions which may be expressed in the following way: During too wet and cold or too dry phases, exemplified by Nos. 13, 11?, 3 resp., 9–7 and 5–4, the cave was not inhabited, while it was occupied during more favourable conditions: occupation levels IV–I and modern occupation (2–1).

In this way the curve from the Zwai-Shala basin was fixed in relation to that of the Nakuru basin. The highest ancient lake of the Tana basin in placed on the vertical A1, as this lake is assumed to be contemporaneous with that of the Nakuru basin. The Tana curve also shows a striking conformity with the Zwai-Shala curve from D1 downwards. It may also be noted that the Faiyum curve resembles the Tana curve very closely if the 44 metre Faiyum lake is placed on the A1 vertical.

It is obvious, I think, that these parallel variations of regression and transgression of the ancient lakes within the different basins cannot depend on mere chance, but must register simultaneous changes of climate in East Africa. In basins without an outlet it

must be the balance between precipitation and evaporation which, in the main, determines the rhythm of the changes of height of the ancient lakes. It is remarkable that this conformity of the curves

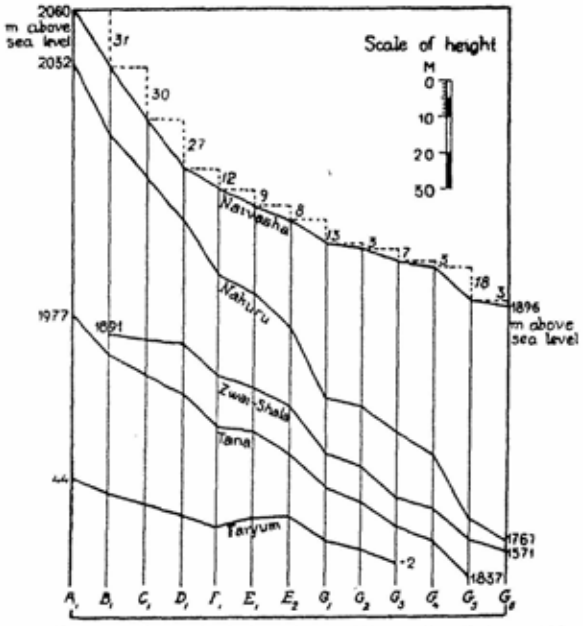

Fig. 8. Curves showing the gradual lowering of the ancient lakes within the basins of Naivasha, Nakuru, Zwai-Shala, Tana in East Africa and the Faiyum Depression in Egypt. The curves are built up on the altitudes of the ancient lakes, marked on verticals at equal distances from each other. The height-figures of the lake-levels from the Naivasha and Nakuru basins are chosen from about the centre of each basin in order to avoid too great disturbances owing to the considerable tilting of the lake-levels in these basins.

can also be observed for basins with outlets where other and local factors influence the height of the lakes. The Tana basin curve shows throughout its length a pronounced similarity to the Zwai-Shala and Nakuru basin curves.

As well as reflecting changes of climate, the curves provide a means for a reciprocal dating of the ancient lakes themselves. In 1938 I tried to date ancient lakes of the Faiyum depression by means of the data then available; since then more detailed graphs have been obtained through the re-investigation of the area by Misses C. Caton-Thompson and E. W. Gardner and by Dr. S. A. Huzzayin. These additional data resulted in the curve at the bottom of Fig. 11.

III. Collective Evidence and the Time Scale

The double registration of climatic changes in East Africa discovered through its high mountains and within its lake basins

is tabulated in Fig. 9. The evidence thus obtained should correspond, as *glaciers and lakes without outlets vary in the same direction under the influence of changes of temperature, precipitation and evaporation.*

By means of available geological and archaeological dating, I have tried to attach this tabulated comparison to the time scale. Varved delta sediments from the closing stages of Lake E, built up to the levels of lakes E3 and E4, are dated to about 7,300 and 6,800 B.C. respectively by Professor G. de Geer. Lakes E1 and E2 which, of course, must be older, correspond to the 17 and 22 metre lakes of Faiyum, which, in turn, are dated by means of implements in their beaches. These two lakes, I understand, now replace the former 18 metre lake and they are then assumed to date back to about 7,500 B.C. This is a remarkably good coincidence in the age of the lakes dated independently and in quite different ways.

The preceding wet sub-epoch registered by lakes D is dated by means of varved clay belonging to lake D1 and measured in a section of the Melawa river. According to de Geer, the measured varves represent the years 12,764 to 12,628 B.C. The corresponding 24 metre lake of Faiyum is, on the basis of archaeological finds, assumed to have existed about 15,000 B.C.

It will be seen from Fig. 9 that not only are the main climatic changes, reflected by increasing and decreasing lakes and glaciers, closely similar in the two areas in East Africa which were investigated, but they also agree with climatic conditions which influenced variations of ancient lakes in the Faiyum Depression.

Just as the mighty sediment of Lake A greatly exceeds both in thickness and extension the next younger lake sediments, so the moraine ridge which marks the maximum extension of the glaciers of the Last Pluvial is much more imposing than the next three younger ridges gathered in a narrow zone. The subsequent very pronounced retreat of the glaciers and lakes as the result of an arid sub-epoch is also manifested by aeolian sediments in the deposits in Gamble's Cave, Elmenteita. Within the Faiyum Depression a similar decrease of the lake nearly caused it to dry up. According to de Geer's dating by means of varved sediments, this arid phase should co-incide with the Gotiglacial sub-epoch which, in Fenno-Scandia, is characterised by a very considerable retreat of the land ice.

In East Africa the comparatively unimportant Makalian wet phase followed and is represented by lakes of the group E. Its first lakes, E1 and E2 should be contemporaneous with the 22 and 17 metre lakes of the Faiyum, but might also correspond to the

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Fenno-Scandian moraines, as the later lakes E3 and E4 are dated as belonging to the middle and the end of the following Finniglacial sub-epoch respectively.

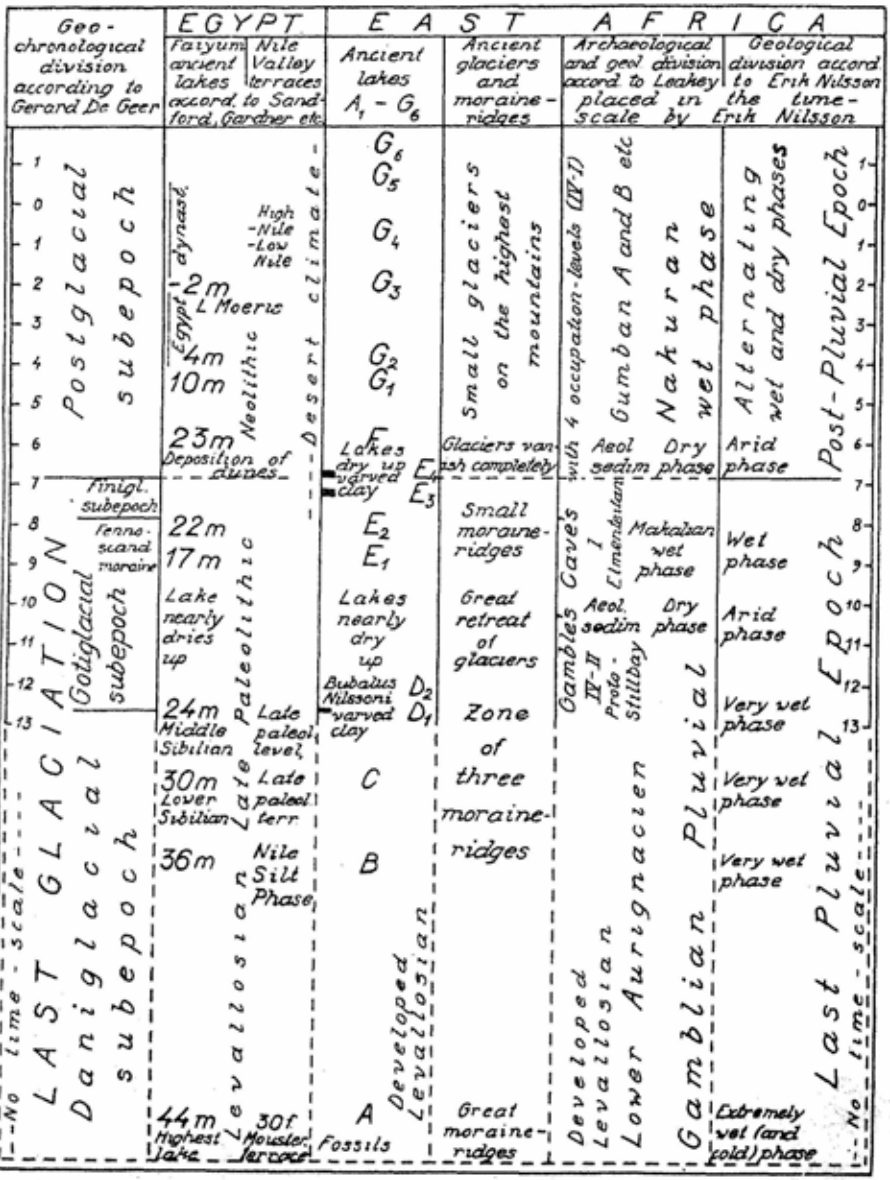

Fig. 9. A correlation of the main climatic changes of the Last Pluvial traced in East Africa and Egypt, attached to the time-scale by means of available geological and archaeological datings.

The arid phase which follows the lakes of group E is regarded as the beginning of the Post-Pluvial epoch. But climatic conditions in East Africa perhaps favour placing the division between the Last Pluvial and the Post-Pluvial epochs in the first of the two arid sub-epochs: that which falls between D and E. Wet and dry phases of minor importance alternate throughout the Post-Pluvial epoch and the wet phases decrease in intensity. According to my comparison, lake G3 should correspond to the 2-metre lake of Faiyum in the Old Kingdom times.

IV. Climatic Changes and Tectonic Events Affecting the Nile Valley

There is, according to K. S. Sandford and W. J. Arkell, a firm connection between the Nile terraces and the oldest of the lakes in the Faiyum district. Thus the 30 feet 'Mousterian terrace' corresponds to the highest of these lakes, and the 'late Palaeolithic terrace' and the 'late Palaeolithic level' were contemporaneous with the 30 metre and 24 metre lakes of the Faiyum respectively. 'The Faiyum lake was filled and controlled by the Nile and its history, therefore, served as an index to the history of the Nile levels of the time', Dr. Sandford writes.

In this history an event of special interest occurs and here again I quote Dr. Sandford: 'By the time the Mousterian culture had become locally evolved to such an extent that it is called by another name (older Sebilian), the gravel was all but past, and the Nile from the Second Cataract northward was overwhelmed by vast quantities of silt. The silt came through the Second Cataract, filling up many of the old channels, and may safely be presumed to have been derived from *farther south*, where climatic changes of enormous importance had taken place or were now going on. The supply there may have been partly aeolian, partly, perhaps, contributed from the basins of the White and Blue Niles.'

This important silt phase is divided into two parts, an aggradation phase in later Mousterian and Early Sebilian times and a degradation phase which belongs to Later Sebilian times. Most of this silt must have come, I think, through the Blue Nile, Atbara and Sobat Rivers *from the Abyssinian Plateau*, caused by the above-mentioned tilting of this plateau. The then rejuvinated erosion of the Blue Nile into the vast layers of soft sandstone of Lake Yaya and into Mesozoic sandstones and limestones provide the conditions and, in my opinion, *the only conceivable means* for obtaining such mighty deposits of mud and silt as those recorded within the

Nile Valley, especially below the Second Cataract where their thickness in places is said to be up to 100 feet.

It seems probable that the highest lake of the Tana basin might have had its outlet towards the north west. If so, the second lake (lake B) was at first drained by the Blue Nile, which must then have been able to cause a more powerful erosion along its great trough across the former area of Lake Yaya up to the basin of Tana. If the tilting of the Abyssinian Plateau was not accomplished until after the oldest wet sub-epoch of the Last Pluvial, this fact would explain why the ancient lake A seems to be lacking in the Zwai-Shala basin.

Conclusions

In Fig. 10 I have attempted to compare the Pleistocene climatic changes in India, East Africa, Egypt, Palestine and Europe. According to investigations carried out by Professor H. de Terra and Dr. T. T. Paterson on the glaciers of Kashmir and the Palaeolithic cultures of the Punjab, there seems to be a very good correspondence between these changes and those of East Africa. The four glaciations of Kashmir and the four glaciations in the Alps must, I think, be considered as contemporaneous. The second, third and fourth glaciations were probably contemporaneous with the three East African Pluvials: the Kafuan, Kamasian and Gamblian Pluvials.

The four terminal moraines in Kashmir seem to correspond to the four ancient lakes A, B, C and D of the Gamblian Pluvial and these lakes in turn, according to my interpretation, to the highest lakes in the Faiyum Depression, the 44 to 24 metre beaches.

The Tyhrrenian and Monastirian terraces of the Mediterranean as well as the Nile terraces are correlated according to Dr. Sandford. The Nile silt aggradation phase comes in after the Mousterian and co-incides with the tilting of the Abyssinian and Somaliland Plateaux.

During the following post-Pluvial epoch, not marked on this table, wet and dry sub-epochs followed each other up to the present time. The present climatic changes which we witness here in East Africa as well as in all other parts of the world are, of course, to be regarded as the present link in the very long chain of climatic changes in the past.

India	East Africa	Egypt	Palestine	Europe
Fourth Glaciation Terminal moraines I – 4 Terrace 4 = T.4	Last or Gamblian Pluvial Terminal moraines	Ancient lakes Upper D – 24m Faiyum Aurignac. Middle C – 30° Sebilian Early Stillbay B – 36° Early Sebilian Silt aggregation Low Aurign. Developed A – 44° Mousterian Levallosian	Pluvial C	Finigl. epoch Gotigl. epoch Last or Würm Glaciation Danigl. epoch late Paleo-lithic cultures Mousterian Terminal moraines
Third Interglaciation Levallosian-late Soan. T.3	Last Interpluvial Volcanic activity Acheul-Levallos.	Interpluvial Monastirian beach of the Mediterranean	Interpluvial c	Last Interglaciation Micoquien
Third Glaciation Potwar loessic silt Late Soan, Acheulean. T.2	Kamasian Pluvial Kamasia sediment Oldowan or pre-Chellean-Acheulean	Little Pluvial	Little Pluvial or Pluvial B	Great Glaciation Riss, Saale Acheulean
Second Interglaciation Chelleo-Acheul.-Early Soan T.I	Kafuan-Kamasian Interpluvial	Interpluvial Tyrrhenian beach of the Mediterranean	Great Interpluvial b	Mindel-Riss Interglaciation pre-Chellean-Chellean
Second Glaciation Boulder conglomerate zone Early flake industry	Kafuan Pluvial Lake Yaya Kafuan industry Traces of flake industry	Great Pluvial "Eolithicum"	Great Pluvial or Pluvial A	Mindel Glaciation "Eolithicum"
First Interglaciation Pinjor zone U.Siwalik fauna			Interpluvial a	Günz-Mindel Interglaciation
First Glaciation Tatrot zone Upper Siwalik fauna				Günz Glaciation

Nile terrace 50Ft-30Ft-10Ft

100Ft

Fig. 10. An attempted correlation between Pleistocene climatic changes.

THE PLIO-PLEISTOCENE BOUNDARY

F. E. ZEUNER

The difficulties which have arisen in recent years in connection with the definition of the Plio-Pleistocene boundary are largely due to the fact that we are trying to define a boundary line which does not exist in reality. In the latest phases of the history of the earth we are naturally anxious to acquire a more detailed knowledge than in earlier periods, not the least important reason being that the

evolution of our own species took place within the Pleistocene. This definition of the Pleistocene by the presence of man, or the Anthropozoicum as a Russian colleague has called it, is fast breaking down because the discovery of implements in deposits of basal Pleistocene makes it clear that man developed into a tool maker at least in late Pliocene times.

There was, however, an additional reason for maintaining the Pleistocene as a unit separate from the Tertiary, namely the evidence for repeated heavy glaciations in the temperate regions of the Northern Hemisphere. The earliest of four great glaciations established in the Alps was accepted as the first geological event within the Pleistocene, *i.e.* the Günz glaciation. Now, however, several glacial phases have been established in the Alps by Eberl as *preceding* Günz. As the latter is the first relatively large and fairly well evidenced glaciation, however, a definition of the Pleistocene by its commencement is of practical value in Europe and that is why it has been most widely accepted.

Since the days, however, when the Alpine scheme of Penck and Brückner dominated the Pleistocene of the world, much work has been done in regions far removed from the glaciated areas. Here the Alpine scheme was found to be inapplicable, and the so-called Pleistocene deposits appear as a mere appendix of the Pliocene. Moreover, absolute chronoloy has shown that the Pliocene lasted some 10 or 12 million years compared with 600,000 to 1,000,000 years for the Pleistocene. Viewed from the standpoint of stratigraphical geology, the obvious thing to do would be to abolish the Pleistocene altogether. The glaciations would be no objection against this, since nobody has ever suggested the establishment of a separate period for the span of time when glaciation occurred in the Permo-Carboniferous of South Africa and elsewhere in the southern hemisphere.

I do not, however, consider it advisable to take this extreme step, largely on the grounds of geological method. Earlier formations than the Pleistocene are studied by the ordinary stratigraphical method, which is a combination of the Law of Superposition and the Law of Faunal Evolution. But in the Pleistocene the stratigraphical method is supplemented and, in some areas, dominated by physiographical methods. In fact the chief justification for maintaining the Pleistocene as a separate unit is that its chronology is on the whole one of *denudation*, whilst the chronology of earlier periods is mainly one of *deposition*.

If then we decide to maintain the Pleistocene, we have to invent a boundary line. It is inevitably arbitrary and it will not be

recognisable in many areas. Many attempts have been made to define such a boundary line. They may be sorted out into five classes.

The first two are palaeontological and are representative of the ordinary stratigraphical method in the Pleistocene. The original definition of the Pleistocene by Lyell was based on the percentage of extinct species present in the fauna of marine mollusca. But since Pleistocene geology is based on terrestrial rather than marine formations, and since the rate of evolution of marine fauna varies considerably, a definition of the Plio-Pleistocene Boundary by marine faunas is of little practical value.

The second palaeontological method is that of using the appearance of certain genera of terrestrial mammalia, such as the horse (*Equus*) or true cattle (*Bos*), or elephant (*Elephas*). It was first suggested by Haug and more recently advocated by Hopwood. But as pointed out by Pilgrim (1944), himself an eminent mammalian palaeontologist, such definition may work in certain areas, but the boundary thus established is unlikely to be contemporary in, for instance, Europe, Asia, and Africa. Time was required for the genera to evolve, and also to spread, and the dates of their *arrival* in different areas are likely to vary to such an extent that they become useless for the purpose of *definition*. Yet, in practice, they are indubitably of considerable value in local stratigraphical work.

The third method is the glaciological one. I am using the term in the unusual sense of referring to glaciations, not to glaciers. Enough has already been said about this method to make clear that it offers an extremely well-defined boundary at the beginning of the first major glaciation, Alpine Günz. The difficulty of this boundary line is that this glaciation, though it has left its traces in the shape of moraines and glacifluvial terraces in the Alps, and of climatic aggradation terraces in the periglacial zone of Europe, was smaller than the succeeding glaciation, Alpine Mindel or, counting backwards from the present day, the Antepenultimate Glaciation. The latter would afford an excellent boundary line in Europe, though one that would shorten the Pleistocene by a quarter and would add many deposits with faunas of the Cromer Forest Bed type to the Pliocene. Such procedure would, I believe, find little favour with Pleistocene geologists, the tendency being rather one of extending the Pleistocene at the expense of the Pliocene. If one adopts a glaciological boundary, therefore, one should remain faithful to the old one at the beginning of Alpine Günz.

The last two methods are physiographical. Both are based on the observation that, broadly speaking, erosion of land surfaces was much weaker in the Pliocene than in the Pleistocene. It appears to be true that a new cycle of erosion began approximately at the time when, on the current vague conception, the Pleistocene would have begun.

In Europe north of the Alps, the rivers of the Late Pliocene (in the vague sense) were flowing in a very mature landscape. In the Sudetan Mountains, Thuringia, the Bavarian Alps, and parts of the Rhine Valley, it is evident that *since* then a new erosion cycle has begun, connected with tectonic movements, along faults in some cases, and wholesale rise of the land in others. Owing to the difficulty of identifying river terraces corresponding to the Günz Glaciation outside the Alpine area, Eberl's work on the Deckenschotter groups is of the greatest importance. Here it can be shown that the intensification of down-cutting began about the Günz Glaciation, possibly slightly earlier.

Similarly, Teilhard de Chardin has pointed out that in East Asia a positive epirogenetic movement rejuvenating the entire Pliocene topography occurred between the Nihowan stage and the Choukoutien stage. The latter being on faunal evidence Cromer Forest Bed Interglacial, the former the Chinese equivalent of the Villafranchian, this rejuveniation would again be more or less coincident with the Günz Glaciation. In his important paper on the lower limit of the Pleistocene in Europe and Asia the late Dr. Pilgrim has undertaken to bring Northern India into line with this conception, and analysed the faunal implications of such a boundary line.

Finally, the succession of Pleistocene high sea-levels also shows that, apart from oscillations due to absorption of water in the ice-sheets, the sea-level dropped since the Sicilian from 80 or 100 m. to the present level. This, of course, is in complete agreement with terrestrial evidence for the intensification of erosion since the Günz Glaciation. On the other hand, during the Sicilian the sea-level appears to have oscillated around the 100 m. mark for some considerable time, so that again we obtain a good boundary line with the drop from the Sicilian sea-levels.

This suggestion of accepting the beginning of the present erosion cycle, due apparently to widespread, perhaps world-wide positive land movements, has the advantage of providing a boundary line which is recognisable in comparatively many areas. It would leave the Villafranchian in the upper Pliocene, and would endorse the glaciological boundary line which has already been so

widely accepted. We should thus escape the rather awkward implications involved in a transfer of the Villafranchian to the Lower Pleistocene, with its inevitable effects on stratigraphical and chronological nomencalture.

THE STUDY OF PAST CLIMATES IN TROPICAL AFRICA

E. J. Wayland

I. Pluvial and Interpluvial Periods and/or Periods of More Rain and Less Rain than the Precipitational Mean of Today

The term 'Pluvial' must be a relative one, although in the minds of many geologists and prehistorians it has come to mean a period of decidedly heavy rainfall which would induce continued torrential conditions in rivers, thus involving a time factor. There has also been a marked tendency to equate high rainfall periods with glacial periods of the higher latitudes. In order to avoid this practice, I have in my own work of late years employed the index letters M.R. (more rain) and L.R. (less rain).

An M.R. is a significant period more rainy than that of the present day in the area to which the change refers and, *mutatis mutandis*, an L.R. is a drier one. If, however, the increase or decrease (however small or large) is consequent upon global climatic factors that expressed themselves in the higher latitudes as glacials in Pleistocene time, then the M.R.s are Pluvials and the L.R.s are Interpluvials. When we are dealing with M.R.s and L.R.s of two distinct and contrasting orders of magnitude (Pluvials and Interpluvials for example) the difference may be indicated by the use of small letters, thus : M.R., m.r., L.R., l.r.

It is important to realise that a rise of, say, 10 inches of rain per annum may have great effects in an area of low precipitation (Lake Rudolph district, with about 10 inches p.a., for example), whereas this rise would have little or no noticeable result in an area of high rainfall (Chirapunji with about 450 inches p.a., for instance), yet each of these increases might be of Pluvial nature.

At this stage it is important to consider the matter of sedimentation resulting from heavy or relatively heavy pluviation, or from a strong M.R. period.

II. Ideal Pluvial or M.R. Sedimentation Sequence following a Dry Interpluvial (or an L.R.) Period

In general, riverine transportation and deposition (sedimentation) have a very close and direct relationship to rainfall, and increase in fineness (decline of grade) in the sediments deposited goes hand in hand with decline of precipitation. The expected result of this is that, over a given reach of a river, deposition should start with a boulder bed and should finish with fine silt, or clay (sometimes sandy-clay), the process being one of long duration. In the tropics, however, although this gradation from extremely coarse to extremely fine material is maintained (apart from interruption) the apparent last phase of sedimentation—the silt, or clayey beds—marks not the last part of the rainfall *decline*, it marks the Pluvial (or M.R.) rainfall *peak* or contains that peak. The rise and decline of a Pluvial, however, will hardly be a one-way process. There will be some reversals, and these should be recorded in the deposits in lakes—especially in those without overflow. By the same token a river during the first half of a Pluvial (or M.R.) passes from torrent to swamp for the following reasons :—

The dry conditions of the Interpluvial (or L.R.) give rise to great accumulations of talus and hill-side rubble, so that when a succeeding Pluvial (or M.R.) is definitely established, after an early seasonal period of strong erosion, the resulting streams are overloaded. As the rainfall increases, however, this overload is moved, and its constituents are rounded and transported until physical conditions necessitate their deposition; meanwhile they have helped to function as scouring agents in the erosion of the river channel. The waterworn rubble and scree, etc. come to rest as a boulder bed of comparatively rapid formation, usually well rounded but not well sorted. The Pluvial (or M.R.) may be, as yet, far from its peak, and riverine transportation and subsequent deposition may be expected to increase. The reverse, however, is the case, because not only has most of the removable talus, rubble and pre-existing gravel, if any, found its way to the river already, but chiefly because the stoney hills of Interpluvial (or L.R.) days are becoming more and more densely mantled by vegetal cover; grasses and shrubs, etc., at first, and forest later. Run-off is thereby greatly diminished. In Uganda the difference of run-off, expressed as percentage of the rainfall, at the bouldering phase, and the peak of a Pluvial (or M.R.) is probably of the order of not less than 75 to not more than 3. In fact, the disparity is likely to be greater.

The quantity and grade of riverine sediment decreases as the rainfall rises. At peak conditions, and before they are reached, fine argillaceous or arenoargillaceous deposits accumulate and continue to do so. As the rainfall decreases wind-blown material may find its way into lakes and coarser material may be deposited in suitable places. Occasional stone-choked runnels are likely to appear. Finally, the whole becomes soil covered as the Pluvial (or M.R.) dies out. Local variations of this order of things must, of course, occur; and in the earlier and later parts of a pluvial more or less undecomposed material (fresh feldspars and the like) may be conspicuous in the deposits.

III. Types of Admissible Climatic Evidence

A sedimentation cycle, such as I have outlined, will always raise a presumption in favour of climatic change, but it is not in itself unquestionable evidence of such change, for climatic, tectonic and some other physical changes produce results some of which are astonishingly alike. In order to establish a succession of two or more climatic regimes in the geological past one must establish (*a*) a climatic change and (*b*) its continuance for a significant period.

Broadly speaking, there are three kinds of geological facts and settings which must be taken into account when considering climatic change. They are these:

1. Local indefinite.
2. Dispersed contemporaneous.
3. Local definite.

The first is common enough, and usually consists of a sudden change of sedimentation, or of oxidation of pre-existing deposits, etc. In at least some of these cases climatic change may seem the most likely explanation, but because of lack of supporting evidence other explanations cannot be excluded.

The second (dispersed contemporaneous) is by far the most important of the three cases listed above. Thus the replacement of silts by gravels, or *vice versa*, may record a climatic event or a tectonic one (or a response to some other physical change such as the establishment or removal of a water blockage of river capture, or a change of type of precipitation without change of amount), but if and when the phenomenon is traced over a carefully studied area sufficiently wide to exclude all but a climatic cause, clearly no other is possible.

Local definite evidence (3) is, as a rule, of sporadic occurrence, and usually consists of a great and sustained change of what

Paterson calls 'power volume' of water, so circumstanced that no other causative factor than climate can be admitted. The waterless gorges and dry waterfalls of Karamoja (N.E. Uganda), and some water-carved rocks of the Nangia hills between Karamoja and Chua, are good examples of this. Wind-blown sands sandwiched in between fine silts on the Nokodyokodi River, Karamoja, are perhaps in the same category, as are the red-dunes that overlie Fauresmith or early Lavellois land surfaces in the Kalahari.

IV. Some Examples from the Kagera Valley

The Kagera River forms part of the southern boundary of Uganda and runs for part of its course in Tanganyika Territory. It has provided sites for intensive study over a period of nine years prior to the outbreak of World War II. A full account of this and other investigations into the Pleistocene record and prehistory of Uganda is in course of preparation. For the present, however, some examples of the climatic evidence afforded will suffice to illustrate the application of the principles briefly outlined above.

We have in this area some highly remarkable climatic evidence of the 'local definite' kind. It consists of now hanging valleys of small catchment area, cutting into pre-existing pediments, and floored by thick alternations of rock rubble (talus) and water-transported material. One of these valleys was trenched and a pit was sunk in it to bedrock through a thickness of about 70 feet. The succession is thus exposed and part of the bedrock is cut through in one place by a gulley and a now extinct waterfall, which completes a convincing story of past climatic changes and episodes. Moreover these same episodes are geologically recorded in greater detail in the main Kagera valley from upstream of the hanging valleys to Lake Victoria. The hanging valley deposits are, from the bottom upwards, as follows :—

7. Surface rubble (which does not seem to be forming to-day).

6. 5½–6 feet of red-brown argillaceous deposit, with some pebbles at the base.

5. About 11 feet of angular rocks and stones.

4. 7–8 feet of grey to light buff micaceous clay, with a few pebbles at the base.

3. 30–31 feet of angular rocks and stones, the largest pieces being up to 5 feet in diameter.

2. 5–6 feet of red-brown clay with an inconstant pebble horizon at base.

1. A few feet of angular rocks and stones overlying more or less polished surface of bedrock suporting some boulders.

The bedrock is quartzite of the Karagwe-Ankolean system.

Here we have a record of a number of alternately wet and dry periods, but the story of the Kagera begins much earlier than the cutting of the hanging valleys.

Examination of a good map of Uganda (the 1,000,000 sheet does very well) shows that the very ancient rivers of that country ran essentially E-W ; but buckling, parallel with the rift, has caused later rivers (running approximately on the same but geographically lower traces as the very old rivers) to flow for the most part in what was originally the upstream direction. The same buckling brought into being the Lake Victoria basin, into which the modern rivers south of 1°N. flow. Recent work has revealed the fact that the great reversal was achieved once and for all in days immediately prior to the formation of what is generally called the End-Tertiary valley-form peneplain.

In addition to recrudescence of this buckling, there has been at least one other at right angles to it—the latest of the movements that completed the hydrographic picture of the Protectorate as we know it now.

Our story begins after the first mentioned buckle, or warp, parallel with the present rift, that gave us at once the depression of Lake Albert, the uprise of the low arch (crest of the buckle) that parallels it on the Uganda side of the lake at a distance from it of about 23 miles, and the relative down-tilt (limb of the buckle) to the east that provided the early Victoria basin. The same tilt resulted in the erosion of new valleys in old courses and produced the erosion surface (so-called peneplain) already mentioned. This surface has since become lateritised, and there are patches of the old gravel in it. There is no reason to suppose that this excavation of the first valleys to herald the present day setting took place under climatic conditions differing sensibly from those of to-day.

Then came a period of aridity or semi-aridity when the valleys were slowly deepened by powerful but ephemeral torrents, and pediments were carved at the base of the hills. This was presumably in late Pliocene times, when semi-arid on arid conditions seem to have gripped the whole of Uganda ; particularly those parts of it that are still the dryest.

But this dry regime, long lasting as it must have been, was

destined to give place to very different conditions. Strong perennial streams began to flow in the valleys and to carve their way into and through the distal ends of the pediments, and so truncated them. In appropriate places thick gravels and other sediments accumulated. It was at this period that the now hanging valleys, already mentioned, were formed, for they too cut the pediments.

Then rivers dwindled and failed, and the gravels were cemented into hard ironstone, patches of which still survive in several parts of the Protectorate. They have yielded some simple Kafuan tools by which they can be relatively dated. I cannot account for the drying out of this and other Uganda rivers on any but climatic grounds (dispersed contemporaneous evidence).

There is nothing to show that this arid, or more probably semi-arid, period was a relatively long one; indeed there is some evidence to suggest the contrary. The bottom rubble in the hanging valley unconsolidated for the most part, except near the main river, probably equates with the ironstone.

Later the rivers began to function again and gravels were laid down on top of the ironstones; they heralded a period of valley erosion always toward the base level of Lake Victoria as determined by its outlet, which appears to have given way from time to time as a jointed dolerite still might be (*e.g.* that at the Ripon Falls—the present outlet and probably the only outlet in the past). The valley was not fully graded when a long dry period set in (equals 30 feet rubbles in hanging valley).

Eventually the rivers began to flow again and down cutting was fast, so that rapids appeared in the main valley and the tributary valleys were left hanging. Boulder beds were formed. Then came an earth movement. It could have been of the nature of (*a*) a sagging in of the Lake Victoria depression, (*b*) an uplift of the basin sides toward the rift, or (*c*) a general uplift with which (*b*) was associated, or it could have been of an entirely different type; namely, a kind of ripple-warping travelling down from the N.E., more or less parallel to the Albertine rift valley, as I think it was. A result of such a movement could most easily have been the raising of the Jinja outlet and relative though slight depression of the Kagera area, so that in course of time (the time being largely dependent upon meteorological conditions) the lake would rise and encroach into the Kagera and perhaps some other valleys. But the earth movement could not have caused the rivers to flow again. Only a climatic change could do that; and the striking boulder beds at the bottom of the deposits and about the convex river sides (*e.g.* opposite Nsongezi) at higher levels testify to the

power of the river that transported these. Enormous supplies of sediments were contributed by the Kagera river to Lake Victoria.

After a great lapse of time, during which stone age evolved from Oldowan and allied cultures to the Acheulean, there came another climatic change. The lake, etc. declined gently, and the M gravel and rubble deposit was laid down. It became a temporary land surface trodden by early man, who left many of his implements behind him. It became ferruginised and can be equated with Leakey's Bed IV at Oldoway. Later, as succeeding deposits show, the waters rose and covered it, only to fall again more markedly. The drop was considerable and the newly exposed land was eroded and much rubble accumulated, but the waters slowly rose again. The rise was discontinuous, and slight reversals gave rise to land surfaces on the lake beds peripheral to the main body of the lake, and these were occupied by early man—just as Leakey has shown they were at this time at Olorgesailie. But the M.R. or Pluvial was declining and rubble continued to accumulate on the hillsides and eroded slopes and in small hanging valleys which remained above lake level. The rubble areas nearest the water provided man with material for the manufacture of his implements and on these rubbles he camped, with the result that to-day they yield not hundreds, nor thousands, but millions of artifacts per acre.

In hanging valleys in the hills the rubbles of the first decline of this Pluvial (the M-horizon) and the second decline and rise and final decline are probably merged in the M-N complex rubble. All this is comprised in what I originally called the Second Pluvial, now known as the Kamasian.

Later, another change is effected. The post M-N., sands, etc. are suddenly replaced (that is without gradation) by light grey clays which are frequently boulder based. This phase apparently follows a surface accumulation of rubble at the hanging valley, and appears to be contemporaneous with the rock gulley and the dry waterfall there. The deposits, starting as they often did in boulder accumulations, end in swamp clays. They contain a temporary dry surface, the 0 horizon, during the declining phase.

What appears to be the last great change recorded in the Nsongezi area is the earth movement already referred to which lowered the Jinja outlet and the country beyond, raised country to the S.W. of it, and probably lowered the country situated about the southern end of Lake Victoria. The drop of the level of Lake Victoria was a double event, the second part of which may well have been due to the wedging out of joint blocks from the Jinja dolerite sill.

This is by no means a complete description of the Pleistocene climatic history of Uganda, nor of the relevant evidence the Kagera valley affords. Moreover, the matter is more complicated than the very brief outline I have given suggests.

MEDITERRANEAN AND TROPICAL PLUVIALS

F. E. Zeuner

Attempts have frequently been made to correlate tropical pluvials with European glaciations. But their contemporaneity has not yet been established and, although it is conceivable that such correlation may prove to be correct, it must not be forgotten that it is based on an *a priori* assumption. Because the sequence of pluvial phases in the tropics is probably incompletely known, and because meteorological conditions in these regions are, and certainly were, very different from those obtaining in temperate Europe, this is an attempt to establish correlation by considering climatic zones successively southwards across Europe and Africa.

Valuable evidence for pluvial phases in the Mediterranean zone has been provided by G. A. and A. C. Blanc. The most important sites are the Lower Versilia in north Italy, the Pontine marshes in central Italy and the Grotta Romanelli in the south. In addition there are the Mount Carmel caves in Palestine which have been so admirably investigated by Dorothy Garrod from the archaeological standpoint. Miss D. M. A. Bate has carried out a climatic analysis from evidence provided by fauna from these caves. From their results and other evidence the following deductions may be made:

1. The Last Interglacial is represented by Monasterian beach deposits. It was decidedly warm, probably warmer than the present Mediterranean climate.

2. The most complete sections available suggest that the Last Interglacial was followed by a group of three pluvial phases, or sub-phases.

3. Of these, the third was the weakest, the second the most intense.

4. Evidence for the third of these has been obtained north of 43° N. latitude only.

5. The second of these phases, on and north of 40° N. latitude began with a humid episode whih was followed by one with a cold and, apparently, more continental climate. The latter disappears farther south.

6. Of pluvial phases antedating the Last Interglacial, evidence is scanty. In the Grotte de l'Observatoire, Monacco, two pluvial phases are indicated between the Great and the Last Interglacial.

Thus, there appear to have been in the Mediterranean zone three pluvial phases corresponding to the Last Glaciation of temperate Europe. Of these only the first two were sufficiently intense to leave traces in the southern Mediterranean. The subdivision of the second phase agrees closely with what one would expect on the basis of the astronomical theory.

Proceeding south from the Mediterranean one enters the Saharan belt of dry, descending air. Climatically speaking, this has always been a permanent feature, though geological archaeological and faunal evidence shows that the degree of dryness was subject to fluctuations in the course of the Pleistocene. We shall have to return to the Saharan belt later on.

South of the Sahara present evidence suggests a smaller number of pluvials which were rather longer than those found in the Mediterranean. Three large pluvial periods have been distinguished: the Kageran, the Kamasian and the Gamblian. The Kamasian in particular appears to have been a period of very considerable duration. If this is so, the possibility has to be envisaged that tropical pluvials are not strictly contemporary with glacial phases in the temperate zone.

From the standpoint of astronomical theory, the main problem is whether the fluctuations of solar radiation caused by perturbations of the orbit were sufficiently intense to influence tropical climates. There is however one feature concerning these fluctuations which can be assessed in its effect of the marginal areas of the monsoon belt: the periodical movement of the *caloric equator*.

The *meteorological equator*, which is defined by the position of the narrow belt of convectionally rising air called the equatorial calms, lies, at the present, north of the *geographical equator*. Its average position is about 5° N., more over continents, less over oceans. The meteorological equator usually separates the frontal and cyclonic weather regimes of the northern and southern hemispheres. Some authorities, however, have pointed out that the position of the meteorological equator can hardly be wholly due to this cause alone, and also that its position agrees with the present position of the line of minimum annual fluctuation of radiation, viz. the caloric equator.

The position of the caloric equator fluctuates between the extreme values of 8° N. and 8° S. and, if the meteorological

equator is linked with it, the position of the equatorial and so-called monsoon rain belt must change accordingly. The tropical rain belts would thus move north and south, each oscillation occupying about 21,000 years. The intensity of these oscillations varies, long periods during which they amounted to 5° to 8° N. and S. alternating with others of lesser amplitude.

During periods of violent fluctuation the present-day tropical zone of equatorial rainfall may well have come to lie sufficiently far north or south to receive only a fraction of its present rainfall. But such phases must have been of short duration, alternating with phases of heavier rainfall every 21,000 years.

Although geological evidence for pluvial and dry phases in the equatorial zone is not yet detailed enough to compare it with the theoretical picture, the evidence provided by Kamasian deposits does agree with what one would expect if this theory were applicable : the deposits suggest a prolonged wet period, but contain numerous land-surfaces which indicate dry intervals.

The effects on the Sahara are much clearer. A northward displacement of the caloric equator brings monsoon rains to the southern Sahara. Southward displacement on the other hand means incorporation of part of the Sudan in the desert belt. For this there is evidence from Pleistocene deposits. It cannot be explained by any theory of pluvials implying generally increased rainfall over the whole earth. Compared with the present position, the northward displacements amount to 2 to 5 degrees. The Sahelian type of vegetation would thus have covered the southern third or half of the present desert. This would have brought the mountains of Adrar, Air, Tibesti and Ennedi into the reach of summer rains. Wadis running north to the Mediterranean would have carried localized vegetation cover still farther north.

Now, the Mediterranean type of pluvial coincides with certain northward displacements of the caloric equator. Thus, while a Mediterranean pluvial watered the northern fringe of the Sahara, its southern fringe enjoyed increased monsoon rainfall. Though for meteorological reasons the dry high-pressure belt is unlikely to have been obliterated completely, the phenomena described may well have led to its reduction to such an extent that, especially along the wadis and chains of hills, steppe and scrublands formed a continuous bridge from the Sudan to the Mediterranean.

This suggestion removes several difficulties of the earlier theory of increased rainfall without the shifting of the climatic belts.

1. It agrees with observations by Gautier and others that the

Sahara never was *wet* and that the most that increased precipitation produced was Sahelian bridges across the desert belt.

2. Some Saharan pluvials appear to have lasted for some considerable time. If the Saharan pluvials were nothing but secondary effects of the glacial phases, not even the interstadials could have been bridged by damp conditions. But the co-operation of the caloric equator with the Mediterranean pluvials creates conditions which would favour the coalescence of pluvial phases into major pluvials. Considering the retardation in the expansion of the ice-sheet relative to the radiation phase which initiated it, and the consequent extension of the Mediterranean pluvial, it is conceivable that the interval between two northward displacements of the caloric equator was so much shortened that the store of underground water accumulated in the first phase helped the vegetation to last through the short dry interval.

The conclusions reached above concerning climatic conditions in the Sahara may now be tabulated as follows :

1. Two short pluvials dating back to about 600,000 years ago.

2. A long dry period (with short wet interruptions) from 430,000 to 230,000 years ago.

3. A very long Saharan pluvial from 230,000 to 70,000 years ago.

4. A possible drier phase about 150,000 years ago. Numbers (3) and (4) would be contemporary with the Penultimate and Last Glaciations plus the intervening Last Interglacial.

5. Since 70,000 years ago the Sahara would have been living on its accumulated water store, perhaps slightly implemented by some Mediterranean rain during the third phase of the Last Glaciation.

This picture has been developed entirely on a theoretical basis, whose value depends on the confirmation or otherwise which will be furnished eventually by geological research. It appears to agree fairly well with present evidence, however. It may be regarded as a test case for or against the applicability of the astronomical theory to the Saharan belt and it is in the hope of stimulating further research in the dry belts of Africa that I have ventured to expound this theory.

Tuesday, January 21st

THE CHRONOLOGY OF THE QUATERNARY IN THE SUL DA SAVO PROVINCE

M. B. Dias

QUATERNARY FORMATIONS IN SOUTHERN MOZAMBIQUE

L. A. Barradas

1. The Quaternary Region of Sul do Save

Nearly one third of the Portuguese Colony of Mozambique is made up of Quaternary formations, the limits of which almost co-incide with the Colony's border. The formations range from early Pleistocene to those of the present day. Some of them have been submerged beneath the sea, or formed by it, and can be seen to-day at various heights above 100 metres. Others were deposited by wind during arid periods, while others again were transported along water courses during pluvial periods. There are also products of organic formations such as *machongos* (peat) derived from a flora typical of swamp waters, and those which due to climatic conditions were altered by silification, calcification and laterisation. These formations have not been studied in great detail, but Freire de Andrade and Professor du Toit group them as a whole calling them Recent.

European glaciers and South African gravels originated the terminology used in sub-dividing the Quaternary. This terminology is not always applicable in this case, so the following is a local terminology embracing the most typical Quaternary formations in the country :

Lower Pleistocene—I. First advance of the sea, Mapaian (at Mapai). II. First retreat, Macondian (at the plateau of Maconds).

Middle Pleistocene—III. Second advance of the sea, Balulian (at Balul). IV. Second retreat, Polanian (at Polana).

Upper Pleistocene—V. Third advance, Bandoian (at Bandoia on the Incomati river). VI. Third retreat, Macaian (at Macaia).

Holocene—VII. Fourth advance, Umbeluzian (at Umbeluzi). VIII. Fourth retreat, Martinian (at St. Martinho).

2. The Main Quaternary Formations

The following is a short description of the most important Quaternary formations in their order of deposition. Some of those in the interior at higher elevations may mark the transition between the Tertiary and Quaternary, but this lack of precison on the border line has an almost universal character.

I. Mapaian

It is likely that towards the beginning of the Quaternary there was a marine advance which reached higher than 120 metres above present sea level, at which height there are traces of beaches of Pleistocene age. Many of the alluvial formations of the Highlands must belong to this period, but they are probably of lacustrine origin and should not be considered as Pliocene. Examples are at Mapai, where there are some river terraces between 60 and 70 metres above normal flood plain ; they contain a quantity of rolled gravels. The terraces north of Mabosi and extending towards the Uanetse are of this type.

II. Macondian

Between two successive advances of the sea there must have been a period of retreat and aridity. Much of the land above 100 metres must have emerged at this time. The reddish sands in the interior resting on formations at about this elevation are of the same age : for instance the plateau of Maconds, which is a typical formation of Northern Mozambique.

III. Balulian

This period marks the second great marine transgression, when the sea reached an elevation of 90 metres. The climate must have been hot and very wet, as seen by the river terraces which accumulated enormous thicknesses of gravels containing heavy boulders. These terraces stand at 30 to 45 metres above present flood plain, are reddish in colour and are the typical formations of this period. The alluvial soils of that time which must have supported a luxurious vegetation, stood at a higher level than the coarse sediments and were eroded little by little. They now have a reddish colour.

Fluviatile terraces of this period abound in the Incomati, Limpopo and Balul valleys and constitute the slopes above the confluence of the rivers. This period was very long, well defined and showed certain climatic variations.

IV. Polanian

During this period there was another retreat of the sea, accompanied by strong climatic changes and with predominance of strong dry winds. This period was responsible for a great increase in our Quaternary areas and includes the following formations :

(*a*) *The Guija clays*. These include all clay formations, some of which are probably old marine muds, always accompanied by more or less coarse sands which must have been left dry by the retreat of the sea. In many places a halophile flora exists and as a rule the ground waters carry too much salt to be of use for cattle or agriculture.

(*b*) *Red Sands*. Along the coast are accumulations of sand dunes of Polanian age which have become flatter with time. Examples of these are at Ponta Vermelha in Laurenco Marques.

(*c*) *Tufaceous formations*. Formations of this nature were probably deposited at this stage or suffered calcification due to the aridity of the climate. There must also exist other formations identical with these but belonging to periods equally dry before or after, and with which they may be confused.

(*a*) *Machongos* (*peat*). These soils appear in the middle of the sands mentioned above and must be of the same age. Equally there must occur peat accumulations in earlier or later formations and it is likely that these deposits went right through the Quaternary.

V. Bandoian.

The next marine advance was not so high and long as the previous one, but reached the 25 metre level. Rivers resumed their torrential regime, but their 15 to 20 metre terraces are usually made up of material derived from higher terraces.

VI. Macaian

During this period of retreat the characteristics are less pronounced. The most important are :

(*a*) *Yellowish sands*. Dunes of yellowish sands deposited at this time are sometimes confused with the reddish or lighter sands of later formations.

(*b*) *Guija clays*. Identical with the ones already described.

(*c*) *Machongos*—also identical with the ones already described.

VII. Umbeluzian

During the Umbeluzian period the sea rose to a little above its present level. During this period, which was prolonged almost to

the present day, were deposited the fertile flats of our rivers. They are composed of clay or clayey silt and occur slightly above present flood plains.

VIII. MARTINIAN

This is a quiet prolongation of the previous period corresponding to recent times, during which the formation of dunes is taking place along our coast : some are not yet fixed, while others have already become so.

THE QUATERNARY FORMATIONS ACCORDING TO THEIR ORIGINS

The formations discussed above may be grouped, according to their origins and independently of chronology, under the following headings :

I. *Marine, estuarine or lacustrian origin*
- (*a*) Guija Clays.
- (*b*) More or less siliceous plateau.
- (*c*) Raised beaches.
- (*d*) Localised diatomite (not yet studied).

II. *Fluviatile origin*
- (*e*) Quartzitic terraces.
- (*f*) More or less calcareous terraces.
- (*g*) Ancient alluvial plains.
- (*h*) Modern alluvial plains.

III. *Aeolian origin*
- (*i*) Red sands.
- (*j*) Yellowish sands.
- (*k*) White sands.

IV. *Organic origin*
- (*m*) Fossil *machongos* (Pedras river).
- (*n*) Present day *machongos*.

THE DEVELOPMENT OF THE SUDAN PLAIN IN THE QUATERNARY

G. ANDREW

There are thick deposits in the areas of the central plain of the Sudan, probably partly late Tertiary and partly Quaternary, but so far no satisfactory fossil evidence of age has been found.

The deposits are of interbedded sands, occasional gravels, and

clays, proved in bores, in the deepest of which they attain a thickness of at least 278 metres. These have been called the Umm Ruwaba Series (Andrew and Karkanis 1945, p. 163).

The Series is probably later than the oldest ' lateritic ' ironstones which is considered to be mid-Tertiary, later than the Hudi Chert (*op. cit.* sup. p. 159) and older than palaeolithic gravels flanking the Nile valley near Omdurman. A pig tooth from Kosti (Hopwood 1929) comes from sediments whose relation to the Umm Ruwaba Series is unknown. The series was accumulated in a depression in the area now occupied by the White Nile and the Sudd. A smaller depression occurs in the Blue Nile valley, similarly filled with sands, gravels and clays.

In northern Kordofan and central and south western Darfur the Umm Ruwaba Series is overlain by the Kordofan sands (Edmonds, 1942), an accumulation of aeolian and dune sands which is continuous over a large area. These sands are now fixed by slight surface cementation and by vegetation.

The usual dune forms are blunted and degraded by present-day rainfall in the main area of their occurrence. At the base of the dunes impersistent freshwater limestone with mollusc shells and diatom beds are found, marking local and short-lived lakes ponded by the advancing dunes in the early stage of the period of formation.

In the central plain the Umm Ruwaba Series is covered by a thick deposit of clay (the ' cotton-soil ') which is a water-carried deposit in most of the area.

The clays of the plain, at altitudes between 360 m. and 420 m., appear to be continuous with similar clays at levels above 420 m. The clays at Gedaref at levels up to 640 m. are *in situ* upon basaltic rock from which they were formed. The clays of the Nuba Mts. occur at a similar level and are derived from the local country rock which is felspathic gneiss and schists.

The age relation of the clays to the Kordofan sands is not known. Near the base of the clays in the Blue Nile valley there is an impersistent bed of freshwater limestone (kankar). In this, near Singa, some palaeolithic flakes have been found, and, in a different locality, the skull of a proto-Bushman (Woodward, 1938).

No trace of any widespread ' lateritic ' ironstone younger than that attributed to mid-Tertiary times has been observed north of 11° N. latitude.

In sands below alluvial clays, under the caisson of the Blue Nile bridge at Khartoum, at a depth of 60–68 ft. below low-water level, an elephant tooth and other mammalian remain have been found (Andrews, 1912). The tooth is regarded by Hopwood as

indicating a middle Pleistocene age for the deposit. The level at which it was found is now below the outfall level of the river northwards over pre-Tertiary rock, indicating that downwarping continued in the Pleistocene.

On the left bank of the main Nile at Omdurman there are gravels with palaeolithic implements, overlying the Nubian Series (Andrew and Arkell, 1943). These are probably older than the clays of the plain, but no direct superposition has been observed. The lack of records of palaeolithic remains in the plain except near Omdurman and below the clays near Singa, is due to lack of exposures of deposits of this age.

It is considered that during deposition of the Umm Ruwaba Series, the depression in the White Nile area formed an internal drainage system and that the outlet northwards to the main Nile valley may not have developed until early in the Pleistocene. The smaller Blue Nile depression, on the other hand, probably drained northwards continuously throughout its formation. Molluscan remains in the clays indicate that it was drained during the deposition of at least the upper part of the clays (Tothill, 1946).

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RECENT PHYSIOGRAPHIC STAGES IN THE LOWER NILE VALLEY AND THEIR RELATION TO HYDROGRAPHIC AND CLIMATIC CHANGES IN ABYSSINIA AND E. AFRICA

S. A. HUZAYYIN

In its present form the Nile represents one of the most recent rivers. Workers in N.E. Africa, Abyssinia and the E. African Plateau have been able to show that at one time three distinct river systems existed, one in each of these regions. The Nubian and Egyptian System depended on local rainfall during the Pluvial Period, and drained what is now desert. River terraces in the

Egyptian Nile, during the Plio-Pleistocene and most of the Pleistocene were formed of gravels and coarse sands brought from the Eastern and Nubian Red Sea hills. K. S. Sandford and W. J. Arkell have been able to suggest that Abyssinian silt did not reach Nubia and Egypt until Middle or even Upper Palaeolithic times. It has also been suggested by Wayland in E. Africa that the Equatorial lakes did not flow northwards until the Second Pluvial, or Post-Middle Pleistocene times. More recent work by E. Nilsson in Abyssinia shows that lake and river hydrography on the plateau has greatly changed since the Interpluvial separating the two major Pluvials there. Tectonic upheavals drained ancient Lake Yaya and led to definite flow of waters towards the N.W., *i.e.* the Sudan Plains of Djazirah. So evidence is now being gradually pieced together to show that the linking of the Upper and Lower reaches of the Nile does not go farther back than the main Interpluvial or rather the beginning of the Second major Pluvial of the Pleistocene.

The arrival of Abyssinian mud in Nubia and Egypt, and the ensuing story of its deposition present interesting material for study. The story is complicated by the fact that cycles of erosion and deposition during the Second Pluvial and afterwards must have been affected in the L. Nile Valley by three factors : (*a*) changes in sea level or in relation of land and sea ; (*b*) changes in climatic conditions all along latitudes between the Mediterranean and Equatorial Africa, affecting water supply in the Nile and Egypt ; (*c*) hydrographic changes in the Upper Nile. We should also note the difference between N. Egypt on the one hand, and S. Egypt and Nubia on the other, in mechanism of erosion (degradation) and deposition (aggradation) as affected by changes in sea level. If the base level falls or rises, its effects in degradation or aggradation respectively would appear in N. Egypt long before they are felt in Uppermost Egypt. Ensuing processes of degradation or aggradation would first start in the north and proceed southwards. As a result of this, and for other reasons too, it is possible to have degradation in N. Egypt and, at the same time, aggradation in Nubia, or *vice versa*.

Thanks to valuable work by Sandford and Arkell the following sequence was suggested :—In the Middle Palaeolithic aggradation took place in N. Egypt, and Abyssinian micacious silt was built up to a height of 6–7 m. above present alluvium. In the late Middle and the Upper Palaolithic aggradation was an important feature in Nubia and Upper Egypt, with Abyssinian silt accumulating up to 30 m. above present flood plain at Wadi Halfa, but falling

northwards until at Nag Hammadi the old silt passes under present alluvium. N. Egypt, on the other hand, was characterised by degradation, which continued right through the late Upper and the Final Palaeolithic, until it gave way to present day aggradation, responsible for the building up of arable land. At present there is aggradation in Lower and Upper Egypt, but the river is degrading its bed in Nubia.

More recent investigations in N. Egypt, however, have shown that the sequence may not have been as simple as that. Levelling has shown that old Abyssinian silt goes as high as 20m. above present alluvium, and that it may have been still higher, as its upper surface has in fact been somewhat eroded. Considerations pertaining to sea level and climatic conditions in Egypt make it unacceptable to date these old silts to the Middle Palaeolithic as Sandford and Arkell suggested. A detailed study (in 1940) of these silts was made at Turah between Cairo and Hilwan. There they were found to reach a level of nearly 41 m. above sea level, that is, 20 m. above present day alluvium. A trench was dug through them at the edge of the valley and reached bed rock on which the silts were found to rest. At the base of the silts a group of flint artefacts was discovered, giving a lower dating limit to them, at least in the area under consideration. The artefacts are microlithic and must be ascribed to a later date than even the Upper Palaeolithic. They may, presumably, represent a facies that lies, in sequence, between the Upper Palaeolithic and the Neolithic (perhaps Final Palaeolithic?) It contains little *lamelles simples*, broken *lamelles à dos*, little burins or even micro-burins, notched blades, irregular forms, etc. Some of the artefacts exhibit wind abrasion, showing that they lay on the ground before they became embedded. Others, however, are quite fresh, and must have been embedded shortly after they were made. The collection is not extensive, and the area excavated to bed rock very small (some 15 sq. m.); but enough was found to establish this special and still somewhat unrelated facies.

It may be said that it is still possible that some of the so-called old silts found by Sandford and Arkell in Northern Egypt at higher levels than the present day alluvium may be of Midde Palaeolithic date; but certainly those that lie on the eastern edge of the valley south of Cairo can only be Final Palaeolithic or Pre-neolithic in date. It is even probable that further excavations in these silts in other parts of Northern Egypt may ultimately result in evidence against Sandford's dating. It may be mentioned here that the rise of flood-water level in the main valley in Pre-neo-

lithic or even Early Neolithic times is corroborated by evidence from the Hawwarah Channel leading into Fayyoum.

But how are we to explain this rise of 20 m. above present level? Detailed study of the silts suggests that they were deposited by high and unusual floods reaching the outer borders of the valley and blocking mouths of lateral wadis and side-openings like that of Hawwarah. Interbedded with the fine silts and the channel-bedded micacious sands and muds of the Nile are angular rubbles from the sides of the valley, or gravels brought by lateral wadis, indicating slight rainfall during a wet (but definitely not pluvial) phase. It is suggested to link this phase of unusually high floods in the lower Nile with a Post-Pluvial wet phase in E. Africa and—of necessity—Abyssinia. It is possible that during the Makalian phase (or part of it) Abyssinia received more rainfall than at present. By that time the Blue Nile had also built up its levées in the Dhjazirah area, and relatively little mud was silted there on the way to Egypt. It is also likely that by Pre-neolithic times the degradation process which had started in Lower Egypt during late Upper Palaeolithic times reached Nubia, and that consequently the earlier Upper Palaeolithic Abyssinian silts were eroded in large quantities from Nubia and re-deposited in Northern Egypt. But this process of aggradation in the North was not a simple one, as the silts there were deposited in two groups separated by a phase of local lateral erosion on the outer sides of the valley. During that phase floods may not have reached so high. Could this be an indication that the Makalian wet phase in the Upper Nile had two sub-maxima? Or is it to be explained by hydrographic changes in some parts of the river system? When the double wave of high floods finally subsided the Lower Nile may have presumably lowered its course by slight degradation owing to narrowing of its water bed, before it resumed its present day slow aggradation some time perhaps during the Predynastic phase.

SOME PLEISTOCENE LAKES IN TANGANYIKA

D. R. Grantham

This paper concerns the Pleistocene and recent geology of Tanganyika and in particular is to draw attention to the existence in Pleistocene times of a large number of lakes.

Already there have been two famous finds in Tanganyika of interest to palaeontologists and archaeologists, at Oldoway and at

Lake Eyasi, and some others. Among the less known finds may be mentioned: palaeolithic implements along the Rufiji for a considerable distance above the Pangani rapids; implements in the Dodoma area; a fine find at Muhinga (1) (in Belgian Territory just across the Ruvuvu River from the Biharamulo District) of hand-axe tools which exactly parallel the finds on the Kagera River by Mr. Wayland; rock paintings in the Singida and Babati Districts; 'bored stones' in the Lupa gold and Shinyanga diamond gravels and bolas stones from many places. A very large area of Pleistocene lake margins should provide numerous sites; in addition there are extensive areas, not necessarily old lakes, covered with late Tertiary or Recent deposits likely to yield archaeological material.

Lake Rukwa has furnished the latest information on high levels. Nearly twenty years ago in the preliminary examination of the Lupa Goldfields (2, 3) it was found that lake beds, composed partly of normal deltaic sediments but largely of volcanic ash, often diatomacious, with alternating gravel beds, covered the lower banks of the Lupa and Sira rivers. The Lupa Fault, which is the eastern margin of the Rukwa Rift, is probably the best preserved of East African Rift faults, showing even slickensides, because it was developed under water or was immediately covered by the waters of the then Lake Rukwa, which was 600 feet deeper than at present. Last year and early this year, the work of Dr. R. B. McConnell and more particularly of Dr. B. N. Temperley, has shown that lake Rukwa overflowed into Lake Tanganyika via the Karema Gap. One of the most extraordinary features is a sand bar or spit, some 20 miles long and generally about 100 feet high, stretching from bank to bank right across the Rift Valley, slightly to the north of this overflow channel. Two different shore lines and beach material, beautifully graded from point to point, have been found and will form the subject of a paper by Temperley. All along the western bank which is the steep face, 2000—3000 feet high, of the great Ufipa plateau block runs a sharp notch which is a wave-cut bench at the highest level of the lake, and which is about 3,230 feet above sea level. Both on the Lupa side and on the Ufipa side piled-up deltaic deposits occur at the mouth of each river which entered the lake. The age of these high levels has not been determined.

In 1937 Mr. G. M. Stockley found fossils in the lake beds at Rungwa (4, 5), which indicated an upper Pleistocene age and which at the time were puzzling because they suggested a connection with Lake Tanganyika which had not then been discovered. It is now held that the Rungwa River was the headwaters of the

Lukuga, and that it was broken across by the Tanganyika and the Rukwa Rifts.

The next Pleistocene Lake is what may be called the Buhoar Lake to the east of Mbeya. The drainage trends suggest that before the outburst of the vulcanicity which culminated in Rungwe Mountain (nearly 10,000 feet high), rivers from this area drained westward either into the Nyasa region or into the Congo drainage, but were dammed up by the Rungwe vulcanicity and formed for some time a lake in which were deposited extensive lake beds, partly sediments and partly ashy material. Finally this lake overflowed and drained eastward, along what is now the valley of the Great Ruaha, to the India Ocean. Even this valley may have been a lake at one time ; there are considerable accumulations of material but their nature has not been determined.

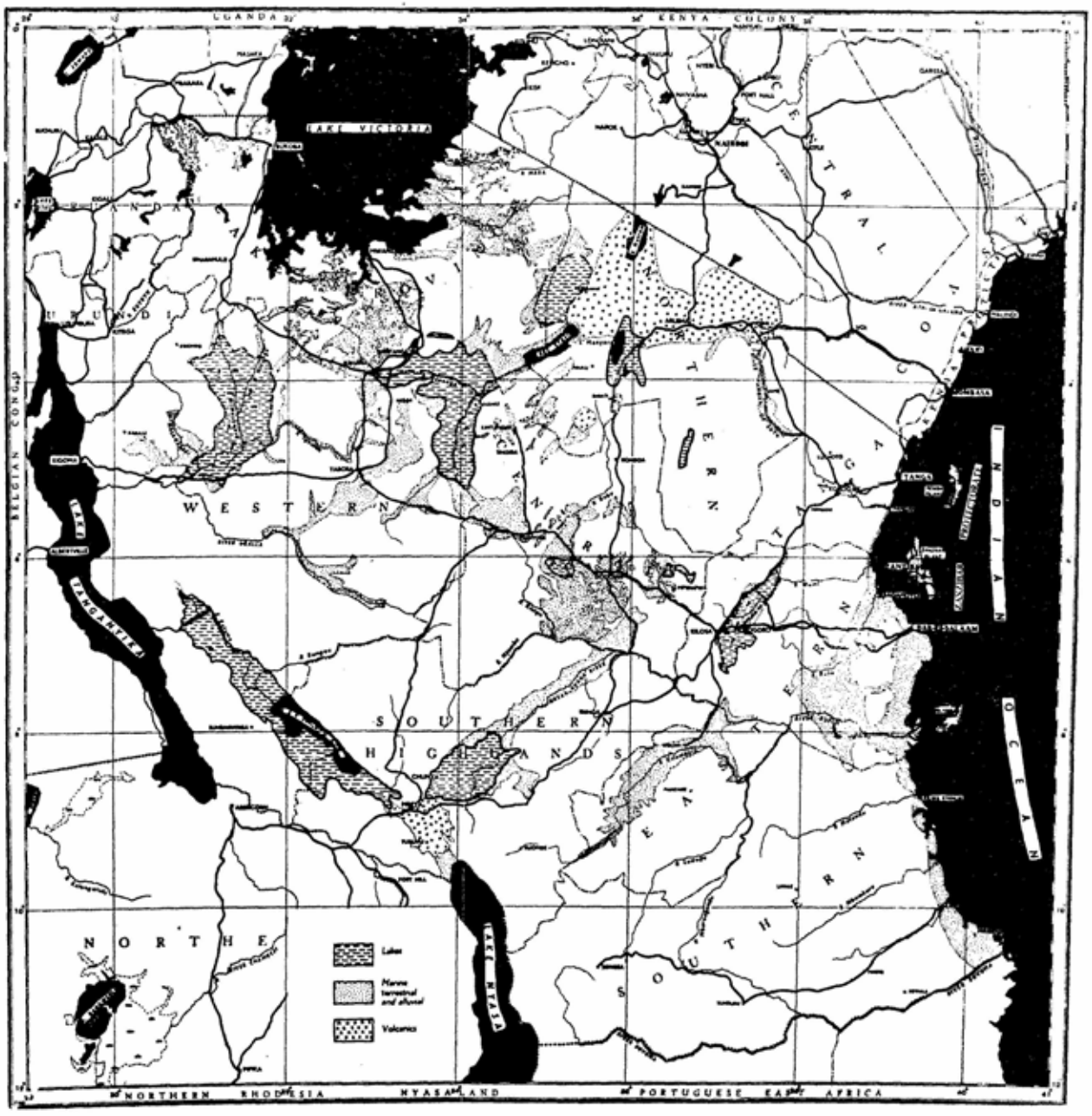
North of the Central Railway is an area almost completely unexplored by geologists and archaeologists. This area contains the swamps of the Malagarasi River and its tributaries, probably once the headwaters of the Nile. During the diversion of its drainage southward, one may assume that it was, for a period, a lake.

One of the most attractive sites for research is the large area of the Wembere-Manonga Lake, lying southeast of Shinyanga, and having an area of well over 2,000 square miles. Lake marls have been extensively deposited and excellent exposures are afforded in cliffs bordering the south of the present Manonga Valley. These yielded fossils of Plio-pleistocene age to Messrs. Stockley and Grace (6). The maximum level to which the lake rose appears to have been controlled by a low spillway into Lake Victoria at a point a little to the south of Smith Sound, and at a height of only 70 feet above present Lake Victoria level (7, 8).

The drainage of the Manonga-Wembere Lake area now goes into Lake Eyasi. Several geologists have worked along the shores of Lake Eyasi but no continuation of the Manonga-Wembere lake beds has been found, although the base of the Eyasi depression is now at about 3,380 feet, whereas the maximum of the Wembere-Manonga Lake was at least at 3,730 and more probably 3,780. Sir Edmund Teale, Mr. Reeve and the other geologists are united in their view that the Eyasi depression is of later date, and may possibly be dated as Middle or Upper Pleistocene.

Here I might digress on to speculations with regard to high levels of Lake Victoria. If ever the lake on the southern side had been 70 feet higher than it is at present, it might have flooded a vast area of Central Tanganyika, but no indication has been found

TANGANYIKA TERRITORY



[To face p. 80

in the Smith Sound—Shinyanga area of such a level. There are various possible features which might suggest it, but definite notching of the topography or high-level beaches have not been found. The author (8) and Dr. J. Williams (7) who worked these areas were definitely opposed to accepting much higher levels for Lake Victoria. Since then Mr. Stockley (9) has found two raised beaches, the highest being 60 feet above present level in the vicinity of Mwanza Gulf; previously he had recorded high level gravels on Majita Peninsular (10), and near Ikungu Mine. It is suggested that the clear high levels on the western shore are due more to faulting and uplift rather than to water level as a whole.

Of the Serengeti Lake, of which the margin is Oldoway, and of the Manyara Lake, I need say nothing, as most of you will be more familiar with the deposits there than I am myself. Across the Masai Steppe there have probably been numerous lakes in Pleistocene times. Our present topographic maps are of course mere sketches as this area has not been surveyed. When the survey comes it will indicate numerous small dislocations of trap-door faulting type similar to the main eastern rift in Tanganyika with its chain of lakes; Natron, Manyara, Balangida, etc. The probability of the existence of several such lakes has been revealed by boreholes sunk in search of water, several of which have penetrated between 100 and 200 feet of calcareous material, which must be presumed to have been actual lake infillings and not terrestrial accumulations. Only three of these are portrayed on the map, but there are believed to be others.

The Mkata Lake lying across the Central Railway is somewhat conjectural, but more than 100 feet of sediments have been penetrated by a borehole. This again is a faulted area; it has had a fascination for economic geologists since German times owing to the possibility of down-faulted Karroo carrying coal in a most advantageous position relative to communications.

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FAUNISTIC EVIDENCE OF THE FORMER DISTRIBUTION OF LAKES AND RIVER SYSTEMS IN EAST AFRICA

E. B. WORTHINGTON. (GUEST SPEAKER)

The present distribution of fauna in African inland waters may be of definite importance as a check to the conclusions on past distribution of land and water derived from studies in geology and archaeology. It may also make a contribution of fundamental importance in evolutionary theory when the dating of past events, such as Pluvial and Interpluvial periods, is more definite.

The fish fauna of East Africa consists of three types: the Victorian, the Nilotic and the Tanganyikan, which will now be considered in turn.

1. *The Victorian Fauna* is found in lakes Victoria, Kyoga, Edward and George. Although differing from each other in some respects, the fish fauna of these lakes is similar in that it consists of comparatively few genera with a multitude of species which are not found anywhere else in the world. Added to these endemic species are a few of wide distribution, notably the lung-fish (*Protopterus*), species of catfish (*Clarias*) and of climbing perch (*Anabas*). These three genera have air-breathing adaptations and are capable of surviving for long periods in swamps and sometimes even in dried mud.

2. *The Nilotic Fauna* is characteristic of the lower parts of the Nile system and also in large measure of Lake Chad, the Niger and the Congo. It has a much larger assemblage of genera than the Victorian fauna, including two important genera of large predators, the 'Nile perch' (*Lates*) and the Tiger fish (*Hydrocyon*). In the Nile system itself the division between the Victorian and Nilotic fauna is clearly marked on the Victoria Nile by the Murchison Falls, but less clearly on the Semliki River by a series of rapids.

Examination of the fishes of Lake Rudolph showed a close association of its fauna with that of the Nile in that it contains the same assortment of genera and sometimes of species. Detailed examination of a long series of specimens, however, indicated certain differences which necessitated the description of new sub-species in a number of cases, notably in the genera *Lates* and *Citharinus*. There are also certain distinct species which have evolved in the lake itself. The conclusion was clear that Lake Rudolph must have had direct water connection with the Nile and that the time of isolation has been long enough for the evolution of some sub-species and species.

In considering such evidence it is necessary to sound a note of warning: systematic groups are essentially populations and therefore should be investigated by the methods of population analysis. For this purpose large samples are required and individual specimens are seldom of value. Moreover habits require study in connection with structure. Such methods can of course only be applied to living organisms, rarely or never to fossils, and herein lies part of the value of evidence from living forms.

3. *The Tanganyikan Fauna* has a still larger assemblage of genera than the Nilotic fauna. Many of these are the same, but a number of others are found nowhere else and have been evolved in Lake Tanganyika itself. In other words, the Tanganyikan fauna has become so distinct through local evolution that many forms have been given generic as well as specific rank. This indicates a very long period of isolation of Lake Tanganyika, a period which was broken when that lake gained contact with the Congo system, probably at the time when the Mufumbiro mountains were cast up across the rift valley, ponding Lake Kivu and adding to the Lake Tanganyika drainage a considerable area which formerly drained to the Nile.

The Separation and Evolution of the Faunas

Considering these three distinct faunas, the Victorian, the Nilotic and the Tanganyikan, the events which led to their separation and subsequent evolution can be reconstructed. It must first be assumed that the great ge-anticlyne which formed the continent of Africa from time immemorial had a system of drainage in which the main rivers had a common origin and were connected by a series of swamps at their head waters such as are characteristic of many African watersheds even to-day. The original fauna was evolved in such a system by invasion of inland waters by marine

forms, and the main families and genera of African freshwater fishes came into being and were distributed throughout the continent. Tectonic earth movements formed what may be described as a dimple near the common watershed and caused a depression draining inwards with more or less isolation of its waters from the original rivers. This dimple has perhaps persisted as the depression occupied by Lake Victoria and Lake Kyoga. The creation of rift valleys both to the east and west of the Victoria depression interfered greatly with the system of drainage and caused further isolation of the fauna. In the case of Lake Tanganyika, the rift was extremely deep and came to be filled by a lake which has survived until to-day. The same applies probably to Lake Nyasa ; but the other lakes, being relatively shallow, were subsequently affected drastically by climatic change.

Up to the end of the Kamasian pluvial, all the waters should on this hypothesis have contained the main elements of the African freshwater fauna, including those predacious genera, *Lates* and *Hydrocyon*. Then, however, came the main period of inter-pluvial desiccation, and I suggest that this caused so great a reduction of water levels that Lakes Victoria, Kyoga, Edward and George were dried up to a few swamps in which the water became so deoxyginated that *Lates* and *Hydrocyon*, together with a number of other characteristic Nilotic genera, were exterminated. But the swamps allowed the survival of the air-breathing forms referred to above.

Following on the inter-pluvial desiccation these lakes at the head of the White Nile system filled again with water, but they had practically no fauna. A few species of fish particularly belonging to the families *Cichlidae*, *Mormyridae* and *Cyprinidae*, obtained entrance, possibly carried by birds or other extraneous agencies, and found themselves in great areas of water with abundant food supply but without competitors, and above all without large predator fish to prey upon them. Their conditions in fact, were such as to stimulate an adaptive radiation or evolutionary effervescence, and the original representatives rapidly gave rise to the variety of unique species which characterise the Victorian fauna of to-day.

The desiccation may also have dried up Lake Albert and Lake Rudolph, but in these two cases the onset of pluvial conditions gave direct contact with the River Nile and hence the lakes were re-colonised by typical Nilotic forms. Lake Tanganyika and Lake Nyasa were too deep to become dried and consequently evolution, which had started in them well before the desiccation, continued

uninterrupted to the present day, in spite of and perhaps even stimulated by, the change of chemical conditions which the alternating pluvial and interpluvial condition must have caused. Lake Tana, by the way, is a separate issue: its multitude of endemic species of *Barbus* indicate an isolated evolution of its own which fits well with the remarks concerning the origin of that lake made by Nilsson.

Among the many factors involved in the above interpretation, I attribute great importance to the biological control of evolution by predators. Certainly the lack of predators was a potent influence in allowing the evolutionary effervescence of the Victorian fauna. When it is possible to date the origin of the present Victorian fish fauna we shall be able to calculate the speed of evolution with perhaps a greater degree of accuracy than in any other known instance. The indications are that the rate of evolution of fish in that region has been surprisingly rapid.

SYMPOSIUM ON PLEISTOCENE MARINE TERRACES IN RELATION TO THE STONE AGE

PLEISTOCENE RAISED BEACHES

F. E. Zeuner

The present heights above sea-level of fossil shore-lines have been widely used in Pleistocene chronology, and the frequent association of human implements with ancient beach deposits has resulted in the names given to the various stages of the Pleistocene sea being in general use in Prehistory. Raised beaches are bound to play an increasingly important part in Pleistocene chronology and in particular in the correlation of deposits from different continents. Most workers in the field of ancient shore-lines have accepted the theory of Glacial Eustasy, but comparatively few seem to be aware of the complexity of the problems involved and therefore it appears worth while to point out some of these and a few of the criteria used.

In studying the elements composing a modern sea beach one realises that it is no simple matter to derive the exact height of an ancient sea-level from any one of its preserved elements. Yet it is essential to determine these heights more accurately than is often done as there is always the possibility that some portions of the coast-line may be affected by tectonic movements, contemporaneous or otherwise. Unless numerous accurate determinations are

made, tectonically (including isostatically) displaced portions of coast-lines are liable to be assigned to sea-level phases higher or lower than the one to which they properly belong.

In altimetric studies of modern beaches *mean* sea-levels are used, owing to the inconstancy of the water-level due to tides and winds. Since tidal amplitudes of several metres are not infrequent, it is desirable that for raised beaches too the mean sea-level should be used. Admittedly it is often impossible to determine the mean sea-level of a fossil beach. On the other hand, certain elements of fossil beaches were formed close to the ancient high-water mark and, provided the locality lies on an open shore, the tidal amplitudes are not likely to have differed much from those of to-day, so that the deduction of half the tidal amplitude from the observed value will yield a result which is nearer the ' fossil ' mean sea-level than any other. Unless measurements both of Recent and fossil beaches are made to refer to mean sea-level as a standard, a world-wide comparison of Pleistocene raised beaches is unlikely to produce concrete results.

Destructional or erosional elements of the fossil beach which have been used in the determination of ancient sea-levels are :— the platform of abrasion, the wave-cut bench, the undercut or notch (often connected with caves), lines of rock-boring organisms, and the cliff. Constructional or depositional elements are : submarine deposits from beneath low-water mark, beach deposits of the tidal zone (sand and shingle, often overlain by dune-sands), and storm-beaches. Whilst some or all of these elements may be found in the cross-section of any one beach, there are also certain physiographical features which help in identifying ancient sea-levels, namely bars, spits, and lagoons. All these bear a more or less definite relation to the actual water-level. Submarine clays with shells, resting on a platform of abrasion, indicate a sea-level several metres higher than the deposit itself. On the other hand, a storm-beach may be more than ten metres above high-water mark, and therefore refer to a sea-level lower by this amount plus half the tidal amplitude. Yet among the innumerable papers on raised beaches there are but few which even mention the beach element to which the given height refers. As regards the altimetric interpretations which may be given to the various beach elements enumerated above, limitations of space forbid a discussion (see Zeuner, F. E., *The Pleistocene Period*, London 1945, pp. 225–231). But there are two particular sets of conditions to which I wish to draw attention, as they illustrate well the problems encountered in work on raised beaches.

The first is the case of *recessional deposits* on an erosional feature, the platform of abrasion or the wave-cut bench. A typical raised-beach section encountered is in a sea-cliff, which consists of rock below and beach-deposits resting thereon. Heights of such exposures are usually given without stating whether they refer to the top of the cliff or to the rock-bench. Let us consider the bench first. If the section lies parallel to the coast-line, this bench appears horizontal (apart from minor irregularities), but in sections at right angles to the coast it rises inland. This bench is either part of the fossil submarine platform of abrasion (below ancient low-water) or of the wave-cut bench (within the tidal zone), and it rises more steeply inland than is often realised. Gradients of the submarine platform are in the order of 1 in 400, and of the wave-cut bench in the order of 1 in 50 to 1 in 10. The ancient sea-level, therefore, to which such bench section refers, was as a rule higher than this bench, and often considerably so. The measured heights of such benches merely provide minimum values for the heights of the ancient sea-levels, to which they more nearly approach the closer the section is to the ancient shore. If the latter is preserved in the form of a buried cliff, there is often a chance to find, or calculate, the junction of the wave-cut bench with the cliff. Occasionally a notch is preserved at the junction, and this feature provides one of the most reliable means of determining the high-water mark, as it is usually within a few feet of the correct value, the error rarely exceeding two metres.

Turning to the deposits resting on the bench, it is necessary to realise that the bench as a whole is an *erosional* feature, and that deposits which are contemporary with its formation are thin and discontinuous, except near high-water mark, where shifting beach deposits may attain thicknesses of several metres. This can be verified on recent coasts where at extreme low tides bare portions of the bench are exposed. In contrast to these conditions obtaining on an active coast-line, sections of fossil beaches often include beach deposits resting on a bench some distance seaward of the ancient shore. In my opinion this is the result of the regression which, in all raised beaches, followed the phase of high sea-level. During this regression, beach deposits were left on the wave-cut benches and platforms of abrasion, and they are successively younger the farther seaward they lie from the ancient shore, although deposition is continuous and therefore appears contemporaneous.

If the raised beach is of the eustatic type, the age-difference between rock-platform and deposit assumes a climatic and chrono-

logical significance. Whilst platform, notch, cliff and the highest landward beach-deposits date from the height of an interglacial period, the recessional deposits on the platform correspond to the beginning of the following glacial phase, during which time the sea-level was falling owing to the locking-up of water in the growing ice-sheets. Implements and fauna contained in such recessional deposits, therefore, do not date from the high-sea-level phase of the platform (to which they are usually referred) but from the early part of the following phase, which corresponds to a glacial phase in the higher latitudes. This is, I believe, the reason why in Europe cold species of mollusca are found in beaches which altimetrically are interglacial, finds which have in the past been quoted in support of the view that Pleistocene *high* sea-levels are contemporary with *glacial* phases.

The second type of raised beaches to which I should like to draw attention is that of fossil coastal bars and lagoons. Their mode of formation was studied and described at length by D. W. Johnson, and a number of stages of development have to be distinguished which begin with the appearance of a spit or off-shore bar, pass through the stage of a lagoon which is virtually cut off from the sea and end with the destruction of the lagoon, the bar having been driven landwards until it is absorbed by the pre-lagoon beach. From the standpoint of fossil beaches it is important that the filling of the lagoon with mud and organic matter will not rise much above high-water mark, except in situations where wind piles dune sand on the lagoon deposits. Where the existence of ancient lagoons can be established on geological and physiographical evidence, the flat surfaces of the ancient lagoon fillings provide a means for determining the height of the respective sea-levels with considerable approximation. Favourable conditions are mostly confined to large bays.

An interesting example is provided by Arabs Gulf, west of Alexandria, a bay of a diameter of 150 kilometres. A critical revision of the terrace sequence of the Nile which was undertaken jointly with Mr. Day Kimball raised the question of the high sea-level phases with which these terraces may be expected to connect. I am indebted to Mr. R. F. H. Summers and to Dr. S. A. Huzayyin for help in my investigation of this area.

Owing to the virtual absence of rivers, and therefore of fluviatile erosion, the ancient coast-lines of Arabs Gulf, the earliest of which lies as much as 40 kilometres inland, are comparatively well preserved. When the effects of wind erosion and deposition have been eliminated, the ancient shore-lines, represented by bars

and occasionally cliffs, stand out with remarkable clarity, and remains of lagoon-surfaces are found to be preserved behind the bars. Ten phases of high sea-level (apart from the modern one) could thus be identified and their elevations above the present sea-level determined. Most values obtained have a greater margin of error than those from the Atlantic coasts of Europe, since triangulation points, bench-marks and contours are not plentiful in a desert area. The sequence of high sea-levels at Arab Gulfs is included in the table below (column 5). Its most remarkable feature is the close agreement with the sequences of southern France and the English Channel, which lends strong support to the theory of glacial eustasy. The agreement is particularly close for the Milazzian sea-level. Another result is the sub-division of what can only be the Sicilian, into five separate phases between 103 and 80 metres. No beach higher than 103 metres has been identified, the topography being radically different above the 100 metre contour. Earlier Pliocene marine deposits however were established by Sandford and Arkell further south, where a gulf existed in the Nile valley, with a coast-line about 180 metres above present sea-level. It is also noteworthy that the latest fossil bar (the ' Harbour Island ' ridge forming the harbour of Alexandria) suggests a post-Monastirian sea-level at very nearly the height of the present one. Evidence for such a phase has come forth in the Thames, where the Lower Floodplain Terrace suggests a sea-level about a metre or so higher than that of the present day. Being followed by the formation of buried channels and preceded by down-cutting from the late Last Interglacial level of the Late Monastirian, this phase has to be assigned to the first interstadial of the Last Glaciation. The discovery of what appears to be its equivalent in the eastern Mediterranean is of interest. Until further evidence for this phase is found elsewhere, however, proving its ubiquity, it is not advisable to give it a name.

The nomenclature of raised-beach levels used in the Mediterranean and on the Atlantic coasts of Europe is not uniform. There are two sets of terms, one purely altimetric and going back to Depéret, the other palaeontological and developed mainly by Issel and Gignoux. They compare as follows :—

For the purposes of correlation in the Pleistocene the altimetric set is preferable. It permits of more detailed subdivision, and one term is available for each interglacial.

In concluding I venture to put forward a plea to regard the geological aspects of work on raised beaches more seriously and to substitute, wherever possible, measurements of definite elements

of a raised beach, and sea-level heights derived from them, for the rather more common rough and unspecified estimates. Visits to existing beaches and the study of contemporaneous sedimentation

Terms		Heights in metres			Stratigraphical division
Altimetric	Palaeontological	English Channel	South France	Arabs Gulf	
Calabrian	Calabrian	?	?	?	?Villafranchian
Sicilian	Sicilian	103	90–100–	103 90+ 85+ 80—100 80	?Villafranchian (Final Pliocene)
Milazzian		56—59	55—60	58	'First Interglacial'
Tyrrhenian	Tyrrhenian	32—34	28—32	35	Great Interglacial
Main Monastirian		18—19	18—20	15—20	Last Interglacial
Late Monastirian		5—8	7—8	5—10	
'First Interstadial'		+1	?	±0	First Interstadial of Last Glaciation

on them are the essential pre-requisites for comparing fossil beaches in the necessary details, so as to avoid many simple pitfalls. In the development of a world-wide chronology of the Pleistocene, ancient shore-lines are destined to play an important part. They are comparatively easy to study, more so than the fluctuations of land climate, and finds of early man will continue to be made on and in raised beaches, so that prehistory as well as Pleistocene geology will benefit from their study.

THE STUDY OF QUATERNARY RAISED BEACHES IN MOROCCO

A. RUHLMANN

RAISED MARINE BEACHES ROUND THE AFRICAN CONTINENT AND THEIR RELATION TO STONE AGE CULTURES

Abbé H. E. P. Breuil

Throughout all ages of human history, sea beaches have attracted man on account of the ease with which he could live there, by fishing and shell-fish eating. In recent times the mass of shell-fish remains accumulated in heaps of almost incredible size give tangible confirmation to this remark.

Except for a few sherds of pottery and some burnt or chipped used stones, there is not much to be found in these shell-mounds. They are generally near the present-day coastline and very few are sand-covered. In older deposits the shells are often bleached and discoloured and have become fragile or reduced to fragments; these shells are sometimes of different type to those now found on the coast, and these deposits do not always follow the coast-line. Small stone tools are found mixed with the shells, very small regular blades, tiny short or rounded ' scrapers ', fine little spindle-shaped or crescent-form points. Sometimes these ' kitchen middens ,' protected by being in a cave, also contain bone or polished ivory tools, or burials in a hole scooped out of the rubbish heap. The burials may be covered by a stone slab, the lower face of which is painted, as in the caves of Tsitsikama. Some of these caves may have wall paintings, usually in not very good style, for the search for and harvesting of shell-fish rarely aroused man's imagination, a gift reserved to those who were great hunters.

In the oldest kitchen middens, the shells have usually vanished and only the chipped stone tools accompanying them remain because of their greater durability. These artefacts are not all of the same age; some lie below high water-mark, under water, and are only accessible at low tide. Others are several feet above, sometimes worn and rolled by a sea which broke 15–45 feet higher than to-day. The latter are long Middle Stone Age points, often triangular, and wide knives and blades. Other raised beaches contain bigger tools chipped on pebbles coming from an old shore line, sometimes rolled by the waves above a certain level, showing that during the Old Stone Age the sea beat at 75–100–200 or even 400 feet higher than to-day: this fact can also be seen by the topography.

Though here and there it is the land that has risen, it is more often the general sea level which has fluctuated considerably,

from 300–400 feet above, to the same depth below the present level. Submarine soundings on the more or less wide submerged border of the continent show washing away and hollowing out by streams and running water, when the sea was much lower. When the sea rose, it naturally hid from our eyes and our research the signs of man's life there. Thus one finds, above a certain level only (and that a very high one), a ' Pebble industry ' in which pebbles roughly chipped by a few blows are the only tools. Naturally we find these on lower levels, but worn and obviously washed down from above.

The Old Stellenbosch culture has heavy, roughly made tools, either chipped directly on a pebble or made from very big flakes struck on an anvil ; they are usually found at 400 feet or more above sea level and are worn by the waves. Such sites occur at Lyndock, Buffeljackets and Keurbooms River.

The Middle Stellenbosch has hand axes on large, wide, flat flakes, often with a striking platform with several facets, and is only found in an unworn state at a level of more than 200 feet (*e.g.* at Stellensboch Valley and Riversdale).

Evolved Stellenbosch tools are smaller, with little finely made hand axes, recalling the Fauresmith types of the Vaal, Riet and Modder Rivers, and occur down to at least the 75–40 feet levels. (Examples are to be found at Cape Hangklip and Fischoek). All of these might be found lower still, worn and derived, but the industry which is found *in situ* below these levels and right down below water, is of Middle Stone Age type.

Analogous facts observed on the coasts of Somaliland, Morocco, Portugal and Syria (amongst other places) seem to be repeated in South Africa. In Morocco, near Casablanca, four successive eaches spread out widely on a gradual slope, the oldest rises to more than 90 metres, the second to 60 m., the third to 30 m. and the fourth to only 15–20 m. above sea level. Each is separated from the preceding one by a series of terrestrial deposits, alluvial, fluvial and consolidated dunes hard enough to serve as building stone, this consolidation having taken place before the following rise of sea level, when the waves cut it into cliffs and caves.

On the surface of the oldest beach containing a Pebble culture, a vast workshop spread itself, with tools comparable to Stellenbosch I, followed by an industry of little flakes. These small tools are found again on the 60 m. beach.

The 30 m. beach contains, brought from we know not where, a number of tools similar to those of Stellensbosch II and, on the surface and in the superimposed consolidated levels, the whole

succession of Acheulean tools. In the 15–20 m. beach there are only Mousterian tools and later types (Oranain or Upper Palaeolithic).

In Portugal, where the beaches are arranged like staircases, the 90 m. level yielded a Pebble industry and a few small tools of Stellensbosch I or Abbevillian type. The sandy 60 m. level was sterile. The 30 m. beach produced Acheulian evolving towards the north into later industries and ending at the 10–25 m. level in a 'Languedocian' of flat, chipped tools and an 'Ancorian' preparing the way for the post-glacial Asturian.[1]

[1] See for more detail H. Breuil, Ancient Raised Beaches and Prehistoric Civilisations in South Africa. Presidential Address to Section E of the S.A. Assoc. for Adv. of Sci., July 2nd, 1947, S.Afr. Journal of Sci. XLIV, 1948.

SECTION II

HUMAN PALAEONTOLOGY

Chairman: PROF. R. DART

Vice-Chairmen: PROF. LE GROS CLARK, F.R.S.; PROF. ARAMBOURG

Monday, January 20th

SYMPOSIUM ON FOSSIL APES IN AFRICA

FAUNAL AND CLIMATIC FLUCTUATIONS IN MAKAPAANSGAT VALLEY: THEIR RELATION TO THE GEOLOGICAL AGE AND PROMETHEAN STATUS OF AUSTRALOPITHECUS

R. A. DART

Shortly after the Taungs discovery, Mr. Eitzman sent to me from Makapansgat valley, near Potgietersrust, specimens of bone breccia blasted out of a local limeworks. The charred and comminuted condition of the bones led me to suspect the handiwork of primitive man. Some of these bones were sent to the late Dr. James Moir and to Dr. F. W. Fox to determine whether they had in fact been subjected to fire. A considerable percentage of carbon was demonstrated chemically and the charring of the bones was therefore claimed to be the work of human hands (Dart 1925).

Recently evidence has been accumulating which suggests that this bone breccia, like the australopithecid breccias of Sterkfontein and Kromdraai, is the work not of man, but of his promethean forerunners. Although the age of all these breccias is apparently Pleistocene, no stone implements have been found in any of them.

Four years later I visited the Makapansgat valley and obtained further specimens of bone breccia. In 1937 Professor C. van Riet Lowe had the opportunity of going to this valley and he examined the caves exposed by later activities of the limeworkers. He has recorded (Lowe 1938, 1943) the stratified and partially consolidated implementiferous cave-earth and ash deposits in the Cave of the Hearths (Fig. 1), ranging through 20–25 feet of cave breccia, and from Late Stellenbosch (or Tayacian or Clacto-Levallois) to Mid-Palaeolithic (or Pietersburg variation of the Middle Stone Age) in lithic technique. The facts suggest that the cave was inhabited during the latter part of the Second Pluvial Period (first or Younger Gravel wet phase of Söhnge, Visser and van Riet Lowe, 1937).

During 1945 and 1946 a number of science students visited this important valley skirting the north-western boundary of the Springbok Flats and brought back a considerable number of geological specimens. These included a new species of baboon (*Papio darti*), a new extinct fossil pig (*Pronotochoerus* sp.) and another baboon (*Parapapio broomi*) which was identical with one which had been extracted from the pink Sterkfontein breccia twelve years previously. This baboon was subsequently found by Dr. Broom to be

Fig. 1. The 'Cave of Hearths' showing the opening formed by partial collapse of the quarry face. The collapsed deposit belongs to the Early Stone Age phase of occupation; the intact roof to the Middle Stone Age phase. (Photograph by courtesy of Professor C. van Riet Lowe).

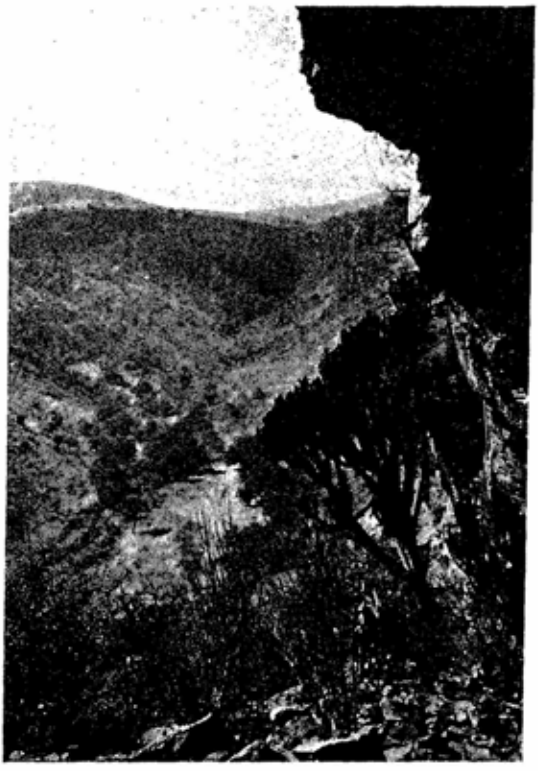

Fig. 2. The head of the Makapan Valley viewed from the mouth of the Historic Cave. This part of the valley belongs to the first cycle of erosion cutting into the Miocene peneplane. (Photograph by courtesy of Professor C. van Riet Lowe).

Fig. 3. A series of distal ends of humeri from the Limeworks breccia, all of which show battering of the articular ends.

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associated with the fauna which accompanied *Plesianthropus transvaalensis* (Broom and Schepers, 1946).

It could now be established that part of the Limeworks breccia was of australopithecid age. The discovery of further primate remains confirmed the presence of *Parapapio broomi* and exhibited a new extinct genus (*Cercopithecoides williamsi*) with the brain case of a baboon but facial parts resembling a giant vervet monkey. This type came from a very differently coloured formation, a pink to red breccia, reminiscent of the Sterkfontein breccia.

Having discovered (*a*) that the grey ash-laden fossiliferous stratum, along with the underlying band of sterile banded lime, lay directly on the dolomitic floor of the cavern, (*b*) that this grey bone breccia was separated from the surface by more than twenty feet of compact pink stratification and (*c*) that both the grey and the pink breccia were sterile as far as human implements were concerned, we were satisfied that the Limeworks breccias could not possibly be contemporaneous with, but were considerably older than, the oldest implementiferous breccias in the Cave of the Hearths.

I had not appreciated in 1925 nor in 1929 how ancient the grey bone breccia might be ; nor did I imagine that it could have been contemporary with, and perhaps even produced by, incendiary activities of Australopithecidae. The absence of stone implements here and their presence in abundance in cave deposits higher up the valley now opened up this unexpected prospect. That the bones have been profoundly altered is patent when they are examined, macroscopically and histologically ; physical action of fire has caused microscopic fragmentation and partially obliterated their Haversian structure, elsewhere replacing bone with translucent glass. Pieces were submitted to Dr. V. L. Bosazza, who has corroberated the work of Moir and Fox by finding repeatedly fragments of dark brown glass intermixed with the breccia. This vitrified material has resulted from the activity of fire in the presence of lime, phosphates and ash, such as necessarily occurs when bones are being vigorously burned in such an environment as this limestone cave afforded. Dr. Bosazza also pointed out that free carbon often oxidises in a few months in carbonaceous clays and shales after exposure to air. The breccias at the Limeworks are lime infiltrated clays and dusts. Hence failure to recover free carbon from carbonized bones in such deposits does not prove that the bones were not fired.

As the result of the collective activities of my students, there have been recovered hundreds of long bone, maxillary, dental and

cranial bone fragments from the fossiliferous strata of the now deserted limeworks.

The Stratification of the Limeworks Cavern

Hitherto, information has been lacking about the stratification of deposits yielding the several representatives now known of the australopithecid group. But we cannot overlook the positive information collected by Dr. Broom that various extinct creatures certainly accompany the man-apes ; nor can we neglect the negative fact emphasised by van Riet Lowe that no stone implements have been found in their vicinity such as might betray contemporaneity with tool-using mankind. The next obvious duty was to decipher the stratificational succession exposed by the limeworkers.

All the cavern deposits in the Makapansgat valley, when not formed by dolomite chips from local weathering, consist uniformly of red wind-blown dust or loess of semi-arid or desert variety. These dusts vary in grain size and have been altered intermittently in the dolomitic caves by the more genial climatic conditions exhibited by lime-infiltrated clays and by consolidation of the dusts with lime. These cave strata are in fact stalagmitic layers of lime-infiltrated clay or loess containing bone breccia.

The recurrence of a 2 ft. – 7 ft. 6 ins. banded lime and lime or travertine layer in all the caves from the Cave of the Hearths at the top to the Peppercorn Cave at the bottom of the valley, shows that the several caves concerned all preserve records of the very early climatic events that the lime and banded lime symbolise. The recurrence of clays over the banded lime later at several caves suggests that a considerable part of the valley may have experienced at that (the earliest known fossiliferous) period, an aquatic state of sufficient magnitude as to be lacustral. Seeing that the Limeworks Cave is only 150–200 feet above the dry river bed, a lacustral or swampy state of the valley is not improbable for Upper Pliocene or early Pleistocene times.

In this connection the description by Miss Elinor W. Gardner of the lacustral tufaceous deposits in the Kharga oasis depression is of interest, as is also her comparison of the tufa-forming process on the plateau at Kharga with the ' catinga limestone ' formation described by J. C. Branner in Brazil (Gardner 1932). R. B. Young (1925) in describing the calcareous tufa of the Campbell Rand at Buxton and Boetsap near Taungs also compared the tufa formation on the fringe of the Kalahari with Brenner's Brazilian tufa formation.

The lime workings in the Makapansgat valley were exploited for the 5–7 ft. layer of almost pure white lime lying under the clay and overlying the banded lime that served us as a stratigraphical base-line. This lime has been leached out from the dolomite and re-deposited as a layer of varying thickness in the crevices of the dolomite and lining the side and floors of open spaces or caverns in its interior. As the overlying cavern earth, even when consolidated by lime, was too defficient in lime to make its removal economically profitable, it was mined and dumped outside only when necessity or safety so demanded. Hence the appearance presented by the present roof of the workings is that of earthy cavern deposits unsupported by their natural floors of lime and underlying dolomite. At Buffalo Cave the richest lime layer was so thin (1–3 ft.) and contaminated with other materials that it was commercially valueless. Sections exposed at other trial workings afford, however, fossil evidence comparable with that found at the lime workings and at Buffalo Cave.

Makapansgat valley is surrounded by hills over 1,000 ft. high, whose bevelled surfaces represent the remnants of the Miocene peneplane. At the head of the valley (Fig. 2) a sluggish stream takes a sudden 500 ft. plunge from a slight gorge to spill over a succession of rock pools ; after a fairly steep course over about a mile, it then disappears underground from its dried-up bed. Further downstream, the river has cut a broad valley. About 150–200 ft. above this flood plain, there is traceable on the hill slope at the limeworks and elsewhere another bevelling which is regarded as having occurred in late Pliocene or early Pleistocene times, and which has exposed over considerable stretches of hillside the consolidated filling of the ancient caverns in which the breccias were formed. The erosion of dolomite leading to exposure of the cemented breccia formed within its caverns (whether as a result of deposition or of collapse through sinkholes) is well-known.

In this connection it may be recalled that the skull of *Paranthropus robustus* was found at Kromdraai, two miles east of Sterkfontein, on the top of a hill a couple of hundred feet above the river bed, in a weathered outcrop of bone breccia of limited extent, that must have formed at one time the floor of a now vanished cave. The Sterkfontein breccia itself is also part of the floor of a similar vanished cave.

A considerable lapse of time is therefore indicated for these comparable deposits at Makapansgat, Sterkfontein and Kromdraai, not only by the filling of the caves and the sealing up of the deposits,

but also by the subsequent erosive action which has destroyed the roofs of the caverns and a considerable part of their contents. Van Riet Lowe (1945) has said 'An important fact which has not yet been recorded, is that in the principal cave at Sterkfontein, we have three very clear and distinct bone-bearing breccias superimposed on each other and each separated from its neighbour by a thick stalagmite.'

Although the Limeworks Cavern with its bevelled breccia is now only 150–200 feet above the dry river bed, the ground surface affording entrance to the cavern prior to its being filled with cave-earth probably stood at a much higher level. But there is a limit to such possible height of ground level for, as L. C. King (1942) says, 'In the Transvaal dolomite area, cavities due to the action of circulating water do not usually occur more than 400 feet below ground level'.

V. L. Bosazza and R. J. Adie, who have been making an intensive study of the history of the Kalahari desert in the light of geomorphology, elicited the above-mentioned geological facts during their visit to the Makapansgat valley (Bosazza, Adie and Brenner 1946). In their opinion, the 50–60 feet of lime-consolidated material found superimposed in various places over the breccia in the floor of the limeworks cavern and exposed and bevelled over hundreds of square yards on the surface above the cavern, accumulated there during the late Pliocene period. In the same fashion, material was deposited in the Cave of Hearths and Rainbow Cave during the Pleistocene period. Thus there were several phases of aridity and aeolian transport of loessic material, the result in brief of one or more eastward invasions of the Kalahari desert. The Limeworks deposit was apparently bevelled in late Pliocene or early Pleistocene times. If their opinion is correct, and if the events depicted in Makapansgat valley are typical of all the known cavern deposits containing Australopithecidae, then they may prove from the geomophological aspect the late Pliocene or early Pleistocene age of their contents.

The lime-consolidated filling of the Limeworks cavern may be divided into :—

1. Overlying reddish-brown loess (9–20 ft.)
2. Intermediate pink loess (1–20 ft.)
3. Underlying grey-white clays (10 ft.)

The underlying clays are stratified and details are given in the accompanying table, which also indicates the fossiliferous beds and

shows an interpretation of the climatic conditions which led to the formation of the various layers.

It will be seen from the Table that *Parapapio broomi* belongs to the geological horizon represented by the grey-yellow fossiliferous clays at the Makapansgat lime-works. This baboon also occurred in the pink Sterkfontein breccia and has been assigned by Dr. Broom to the fauna contemporary with *Plesianthropus transvaalensis*. Broom has argued that *Plesianthropus* is of Upper Pliocene age owing to the presence of the following fossils : two sabre-toothed tigers, *Megantherеon barlowi* Broom, allied to *Megantherеon falconeri* (Pomel) of the Upper Sivaliks, and the small *Megantherеon gracilis* Broom ; also an extinct hyaena, *Lycaena silberbergi* Broom, differing from both living hyaenas and the extinct *Crocuta spelaea* Goldf. of the early Pleistocene of Europe ; also another sabre-toothed tiger, *Machaerodus transvaalensis* Broom, found at Bolt's workings about a mile and a half west of Sterkfontein. Comparison of the lower Limeworks fauna with that of Omo in East Africa suggests that both are of approximately the same age, viz. Kageran, or broadly Lower Pleistocene.

The overlying reddish-brown loess layer yielded the two advanced cercopithecines, *Papio darti* and *Cercopithecoides williamsi*. From it came also remains of hyaena, jackal, rock rabbit, horse and several antelopes. In general the fauna is distinct from the Sterkfontein type of fauna and resembles rather that of the Kromdraai breccia. Comparison with the faunas of Omo and Oldoway suggests that this fauna is still of Lower Pleistocene (Kageran) rather than Middle Pleistocene (Kamasian) age.

Desert Barriers and Human Differentiation in Africa

The Limeworks stratification shows that we have in the Makapansgat valley, in addition to the Middle Pleistocene tool-records of the Cave of the Hearths and Rainbow Cave, an earlier cavern helping to bridge the Pliocene-Pleistocene gap. It has yielded two superimposed loesssic deposits with at least two distinctive faunas comparable with and corroborative of those regarded by Dr. Broom as contemporaneous with *Plesianthropus* and *Paranthropus* respectively. In the so-called Buffalo Cave a mile further down the valley, from which Dr. Broom in 1937 described an extinct dwarf buffalo (*Bos makapani*), and also in the recently investigated Peppercorn Cave, Mr. S. Brenner has discovered comparable stratified records. In the upper levels of Buffalo Cave, however, there occurs a fauna which appears to be of the same (Kamasian) age as that of the Younger Gravels of

the Vaal River, although no associated implements have yet been found. The relation between this deposit and the lowest implement-bearing horizon of the Cave of the Hearths has still to be determined.

The phenomena we find depicted at these several sites in the Makapansgat valley are therefore not local or capricious, but general and climatic; they apply to the Transvaal as a whole. They are fluctuant and therefore of considerable climatic significance for recent geology and anthropology, since they record at least one and possibly several eastward movements of the Kalahari desert.

The evidence for the Older Gravels of the Vaal River (Lowe 1937) shows that it was during the early part of the interpluvial phase between the Kageran and Kamasian pluvials (but before the Kalahari expanded eastwards over the Vaal basin to cover up these Older Gravels with its red desert sand) that the makers of stone tools first appeared in South Africa. When large scale erosion occurs for the second time (the so-called First Wet Phase) and the Younger Gravels were formed, tools of Stellenbosch (Chellean) I and II are characteristic; these are improved upon (Stellenbosch III and IV) in the successive (second and third) phases of these Younger Gravels. There has hitherto been no cavern record of man during the Early Pleistocene in South Africa of the makers of Pre-Stellenbosch tools, unless we have the records in the australopithecid deposits. Nothing skeletal has been recovered in the Vaal valley to throw light on man or the contemporary fauna during the short post-pluvial interval during which the pre-Stellenbosch folk appeared briefly on the Vaal scene. When tool-making man arrived in the Vaal basin, he was soon driven away by the desert and he returned only when the desert had retreated to the west.

When the several expansions of the Kalahari portrayed in the Limworks cavern occurred, the desert was probably twice as wide as it is generally depicted and may have crossed the entire Continent from east to west. In a letter from H. B. Maufe (in which he pointed out that the red sand northward of Mochundi was definitely Pliocene in age) he says: 'It is quite possible that what must be admitted as Kalahari sand was accumulated or re-deposited in Stone Age times'. Desiccation was so great as to sever the continental fauna and allow the passage across the transcontinental desert only of desert-loving antelopes, according to Dr. Austin Roberts (1937). This diagonal separation of the south eastern portion of Africa from the remainder of the continent was apparently not a single but rather a recurrent type of desiccational event.

General J. C. Smuts (1932) placed an extensive desert in the interval between the Lower and Middle Stone Ages. That desert may have provided the loessic dust of the Cave of the Hearths. Söhnge, Visser and van Riet Lowe found another arid period between the Pre-Stellenbosch and Stellenbosch periods. If the desert expanded in this repetitive way, the African continent has been repeatedly divided by enlarged and possibly confluent Kalahari and Sahara deserts into western, north-western, north-eastern, central and south-eastern pockets of proto-human and early human occupation. These continental coastal pockets by their geographical separation could have formed laboratories of adequate potency to provoke the generic and specific differentiation of mankind as well as to cause the dispersal of the resultant morphological types of humanity now found on the earth's surface.

The Promethean Habits of the Australopithecidae

The Limeworks deposits have yielded new information concerning the proto-human habits of the South African man-apes. The breccias consist of middens composed of the comminuted bones of game of all kinds, both large and small: ungulates, carnivores, rodents, primates and birds. The bones have for the most part passed through fires which (because of the amount of carbonaceous, ash-like and vitreous material in the breccias) must have been stoked in the caves themselves. Hence the use of fire is a pre-palaeolithic and pre-human discovery, unless we ascribe the epithet human to the humanoid (or man-ape) creatures contemporary with the breccias.

Twenty odd years ago I thought that articulate speech was the barrier that separated man from the man-ape; evidence accumulated since then has led me to believe that articulate speech is a relatively recent discovery of *Homo sapiens*. The Makapansgat valley limeworks fire-middens indicate that the South African man-apes were hunters of large game in terrifying possession of Heraclean club, Samsonian jawbone and Mowglian firebrand; unless speech was also a barrier, they are separable from man only by the intellectual wall that was finally breached by implements of stone.

When describing the dentition of *Australopithecus* (1934) I drew attention to its 'overbite' and 'lateral overlap' as characterising the humanoid omniverous-carniverous and masticatory dental habits of the man-like apes as contrasted with the frugiverous and tuberculo-sectorial dental habits of living anthropoids. It was pointed out that the absence of enlarged canines in a man-like

ape living in South Africa 'implies on first principles erectness of posture, liberated hands and a compensatory increment in intelligence—habitual instinctive and intellectual control over the movement of the hands, especially in offence and defence, and an increased capacity for suitably selecting and accurately employing natural objects as tools and weapons'.

These conclusions drawn from the anatomy of the Taungs infant and the nature of the concomitant breccia were not modified but confirmed by the adult remains of similar man-apes found later at Sterkfontein and Kromdraai. The recent discoveries at Makapansgat valley limeworks have brought to those deductions based on odontological studies between 1925 and 1934 an extension and corroboration of quite unexpected character: we can no longer regard fire-making as distinctive of man.

The Ancestral Character of Fire (wood) and Bone in Human Culture

Although an erect posture, freedom of the hands, the use of lethal weapons and a predacious carniverous hunting life had been postulated for *Australopithecus*, my imagination baulked twelve years ago at the idea that promethean habits preceeded lithic accomplishment in human evolution and that implements of wood and bone antedated those of stone. But ideas of the latter sort have been put forward relative to human pre-history in Europe. Oswald Menghin (1937) said 'I believe that a third great cultural cycle should be distinguished, to which I have given the name "Bone Culture". I based my theory on the remarkable interglacial sites which have been discovered in the Alps of Switzerland and Austria since 1912 . . . We have three great belts of Protolithic civilisation in the Old World: in the north bone cultures, in the centre flake cultures, and in the south hand-axe cultures.'

Menghin discussed the possible origin of each of these three divergent belts of culture either directly 'from a wood stage following the distribution of mankind all over the world' or their 'coming into existence one after another in the course of the gradual occupation of the inhabitable parts of our globe'. He pleaded for the latter conception, but in any case thought 'that the primordial wood culture was first followed by a primitive bone stage'.

The oldest human cultures of Czechoslovakia and Silesia and the interglacial bone cultures of Switzerland and Austria appear to be very similar to, if not identical with, the fire and bone culture of the man-like apes of South Africa. A number of likely-looking

THE SUCCESSION AT LIMEWORKS CAVERN

Thickness	*Deposit*	*Climatic Conditions*	*Fossil Evidence*	*Other Remarks*
9–20 ft.	Compact reddish-brown loess	Humid Arid	Sterile, except for rodent bones at base	Infiltration of underlying layers by lime indicates renewed humidity. Dolomite chips and boulders present
1–20 ft.	Consolidated pink loess	Arid	'Savannah' fauna similar to that in clayey stalagmites	
10 ft.	Indurated Clays (impure stalagmites)			
4 ft.	(*f*) Compact grey-white	Humid	Sterile	
18 in.	(*e*) Reddish-grey (loessic)	Arid	Sterile	
6 in.	(*d*) Porous, umber	Arid (?)	Sterile	
18 in.	(*c*) Yellowish-grey	Arid (?)	Fossiliferous; *Parapapio broomi*, *Griquatherium*	Layer (*c*) contains large grains of plagioclase feldspar
9 in.	(*b*) Pinkish-grey	Arid (?)		Layers (*c*) and (*b*) contain quartz and chert loess
2 ft.	(*a*) Compact, grey-white	Humid		Layer (*a*) formed in ponds
5–7 ft.	Pure lime	Humid	Sterile	Fluviatile conditions
6 in.	Banded lime	Arid, becoming humid		Alternating layers of lime and sand. Fluviatile conditions ?
	Dolomite cave-floor			

long bones have been found in the breccias that may have served as implements. Despite the prevalence of antelopes, anything sharp, like their horns, has vanished. The ends of the femora and similar long bones, parts that were useless presumably for bone-marrow, have none the less suffered in most cases from repeated impacts with hard substances that have caused their fracture before they were discarded : they are *utilized* long-bones (Fig. 3).

The existence of the australopithecid breccias indicates that the primordial wood stage—if it ever existed independently from a primitive bone stage—did not follow, but rather preceded the distribution of mankind all over the world.

Lacking manufactured implements of stone, these creatures were able to destroy big game animals by virtue of their superior intelligence, their dexterity in wielding clubs of wood, bone or horn, and their management of fire.

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THE FOSSIL APE-MEN OF SOUTH AFRICA

R. Broom, F.R.S.

Towards the end of 1924, a quarry man, Mr. M. de Bruyn, at the Lime Works near Taungs, blasted out from a deposit of impure lime the skull of an interesting ape or ape-like being. De Bruyn was quite familiar with the baboon skulls that had previously been found, and he was sure this was something quite different. It was far more human-like. He took the specimen to the Manager, Mr. A. E. Spiers, and tried to persuade him that it was the fossil skull of a Bushman.

Mr. Spiers sent the skull to Prof. Dart of Johannesburg for critical examination. With amazing skill and rapidity Dart removed all the matrix from the face, and revealed the skull of a young primate with perfect face, and most of the brain cast. The teeth also were in perfect condition.

The skull was seen to be that of a young man-like ape with the milk dentition, but with the first true molars coming into use. Though the skull in size was not unlike that of a young chimpanzee, it differed in having teeth more like those of a human child, in having no trace of a supra-orbital ridge, and in the brain, being dolichocephalic. Further the convolutions of the brain cast were far nearer to those of man than to those of the chimpanzee. The lunate sulcus was far back as in man, and thus quite unlike that of the living apes.

Dart named the little animal *Australopithecus africanus* and considered that it represented a family somewhat intermediate between the higher apes and man; and thus a type nearer to the human ancestor than had ever before been discovered.

When Dart's first announcement was published in England on 7th February, 1925, all the leading English anatomists agreed that Dart had made a serious mistake, and considered that the little fossil was only the skull of a young chimpanzee or of a nearly allied ape.

From my examination of the skull, in February 1925, I was convinced that Dart was right, and I wrote a number of papers supporting him against his opponents. Sollas of Oxford, and then Elliot Smith of London, were converted; but still as the skull was that of a young child the world remained in doubt, and we had to get an adult.

In 1934, I was given a post in the Transvaal Museum; and in 1936, I started to hunt in the Transvaal caves for Pleistocene mammals and especially for any remains of primitive man or his

ancestors. After working at some cave deposits near Pretoria, with very promising results, I became interested in the Sterkfontein Caves ; and here on 17th August, 1936, Mr. G. W. Barlow handed me a brain cast that had just been blasted out. It was clearly the brain cast of an ape-man allied to that of Taungs, but with a small and differently shaped brain. A two days' search among the blasted out material yielded us the nearly complete skull, but without the mandible.

This Sterkfontein skull is that of a young adult with most of the teeth in perfect condition. It has a small brain of about 450–500 cc., but of a remarkably human type. It was called *Plesianthropus transvaalensis*.

For about three years quarrying operations continued at Sterkfontein, and except for about six months in 1937, when the writer was in America, the workings were constantly visited, and portions of other skulls and fragments of skeletons were obtained, and many well preserved teeth.

On the 8th June, 1938, I obtained from Mr. Barlow the palate of a somewhat different type of ape-man. It had been picked up on the farm Kromdraai, about two miles away, by a schoolboy, Gert Terblanche. The site of this discovery was explored, and as a result much of the face, side of skull and a good lower jaw were found with all the more important teeth. This was a new type of ape-man with a much larger brain, and with important differences in the skull and teeth. It was named *Paranthropus robustus*.

We now have three types of fossil Ape-men from South Africa—Australopithecus known by a young child's skull, and Plesianthropus and Paranthropus known by adult skulls. Full accounts have been published of all the known remains and teeth. What concerns us now are the conclusions to which we must come.

The ages of the deposits are still uncertain, but we can I think state with considerable confidence that the Taungs ape-man is much older than the others, and, quite certainly, that this ape-man lived in caves in desert conditions. Most probably the Taungs deposit is Upper—possibly Middle-Pliocene.

The Sterkfontein and Kromdraai deposits are possibly Upper Pliocene, but more probably Lower Pleistocene. Antelopes were certainly contemporaneous with the Sterkfontein ape-man, and horses most probably with the Kromdraai.

The milk teeth are fully known in the Taungs child, and they are almost exactly similar to those of the Bushman and very unlike those of any living Anthropoids. The adult first molars of Austra-

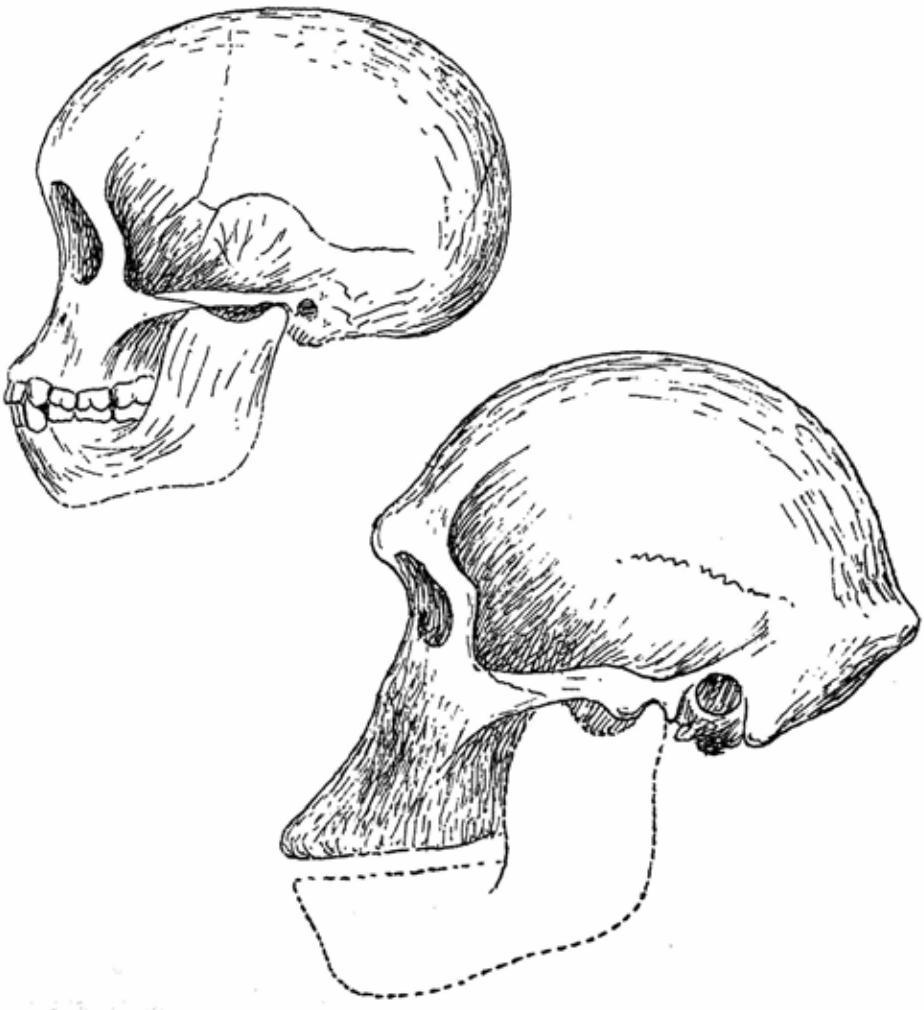


FIG. 1. (Top left). Side view of skull of child *Australopithecus africanus*. Half natural size.

FIG. 2. (Bottom right). Skull of an elderly female *Plesianthropus transvaalensis* (Broom) Half natural size. The mandible is restored from the recently found male mandible and is reduced to fit the female skull.

lopithecus are also typically human in structure, but larger than in man.

The teeth of Plesianthropus and Paranthropus are also almost human, but larger than in living types of man. Plesianthropus has an enlarged canine, which is not quite human. The lower one at

FIG. 3. Side view of skull of *Paranthropus robustus* (Broom). Half natural size.

least has a distinct posterior cusp. In Paranthropus the canines are small, and scarcely different from the human type.

The brains of these ape-men vary in the known specimens from 450 cc. to 650 cc. ; but other specimens may turn out to have larger brains—perhaps 750 cc. or more, and thus to equal in size some of the brains of Pithecanthropus.

There can be no doubt that Dart's discovery of Australopithecus has opened a new chapter in our knowledge of human origins. It was the first discovery of a family of pre-men, from some member of which man as we know him almost certainly arose.

The later discoveries have shown us good reason to believe that this family of pre-men is not closely allied to the chimpanzee, but must have branched off from the Anthropoid stem very early —possibly in Oligocene times.

The discoveries made in Kenya, and described by Hopwood, MacInnes and Leakey have shown that Africa has another family of fossil Primates, also of great importance in the evolutionary history of the Anthropoids and Man. Proconsul, Xenopithecus and Limnopithecus are three allied types of early Miocene anthropoids or pre-men. Unfortunately except for a very fine mandible of Proconsul and some mandibles of Xenopithecus and Limnopithecus, a good fragment of the snout of Proconsul, and a few ankle bones, little is known except teeth. These remains are at present being restudied by Prof. Le Gros Clark, and until his paper appears it is better to keep an open mind. Prof. Arambourg of Paris has definitely placed Limnopithecus on the line which leads to the Australopithecines. This view is supported by the fact that Limnopithecus apparently has a molariform first lower milk premolar, and by the fact that the lower canine in the adult has a posterior cusp. In Xenopithecus there is also known to be a posterior cusp to the lower canine. Leakey has shown that Proconsul has a mandible with very little of the simian shelf, so well marked in anthropoids. On the other hand the dentition of Proconsul and its allies agrees pretty closely with that of the living anthropoids.

In the near future we hope to get further specimens which will help us to decide whether the Australopithecines and man arose from a Proconsul-like group or from a still earlier and less anthropoid group.

ANATOMICAL STUDIES OF FOSSIL HOMINOIDEA[1] FROM AFRICA

W. E. Le Gros Clark, F.R.S.

The following preliminary notes are based on the personal study of the fossil Australopithecinae made possible by the generous facilities provided by Professor Raymond Dart and Dr. Robert Broom, and of the fine collection of early Miocene apes discovered by Dr. L. S. B. Leakey and his colleagues in Kenya.

The fossil australopithecine material has already been described in detail in numerous publications by Dart, Broom and Schepers (for a full bibliography see the references in the recent monograph by Broom and Schepers, 1946). Three possible interpretations

[1] The term Hominoidea is taken from G. G. Simpson's recent classification of mammals (1945). It connotes a superfamily of the Order Primates, which includes man and the anthropoid apes.

of these fossils are open for consideration. They might be nothing more than extinct varieties of ape closely akin to the chimpanzee and gorilla. They might have no special relationship to the gorilla and chimpanzee, but nevertheless represent a collateral group of the large Pongidae showing certain human characters developed as the result of parallel evolution but not necessarily indicative of any direct affinity with the Hominidae. Lastly, they could be regarded as extinct hominoids which, while still at (or, at least, close to) the simian level in their cerebral development, were early representatives of the hominid sequence of evolution and thus quite distinct from the Pongidae. The first two possibilities can now be certainly excluded, for (as Dart and Broom have repeatedly emphasized) the human resemblances in the skull, dentition and limb bones are so numerous, detailed and intimate as virtually to preclude the introduction of the idea of 'parallel evolution' in order to explain them. In other words, there must be a relatively close zoological relationship between the Australopithecinae and the Hominidae. The outstanding human resemblances in the skull structure and dentition may be listed as follows :—

(1) The absence of strongly developed muscular ridges or a nuchal crest in the occipital region of the skull. (2) The relationship of the frontal pole of the brain to the glabella and nasion resembles that found in primitive types of the Hominidae. (3) The details of the supra-orbital region of the skull of *Australopithecus* are quite unlike those of the recent apes (at any stage of their growth) and reproduce the characteristic features of this region in *Homo* in a remarkable way. (4) The contour and orientation of the zygomatic bone show certain detailed resemblances to *Homo*. (5) The construction of the temporo-mandibular joint shows many resemblances to that of man (as already described in detail by Broom). (6) The contour of the body of the mandible of *Paranthropus* is human rather than simian. The horizontal curve of the outer surface of the body (approximately half-way between the alveolar and lower borders) coincides to a remarkable degree with that of the Heidelberg mandible. (7) The forward position of the foramen magnum on the base of the skull, relatively to the auditory region, approximates to the human condition and contrasts rather strongly with the gorilla and chimpanzee. (8) The human characters of the dentition, as shown in the form of the dental arcade, in the proportions and cusp patterns of the permanent teeth, and in the details of the milk teeth, have been attested by so many well-recognized authorities on comparative odontology that it is hardly necessary to enumerate them again. It may be said,

however, that these human characters obtrude themselves much more forcibly on the notice in an examination of the original material than in an examination of casts.

The limb bones discovered by Dr. Broom and assigned by him to *Paranthropus* and *Plesianthropus* present many remarkable features of a hominid character. Indeed, the combination of limb bones so human in many of their anatomical details with a brain development scarcely exceeding that of a chimpanzee or gorilla inevitably raises the question whether they are correctly to be associated with the fossil remains of the skulls. But the circumstances of their discovery, together with the internal evidence which they present, leaves no reasonable doubt that it is legitimate to do so. The lower end of the humerus and the upper end of the ulna of *Paranthropus* lack the powerful development of muscular ridges and crests which are commonly to be found in the brachiating apes. The talus of Paranthropus and the capitate bone of *Plesianthropus* show an interesting combination of human and simian features. The lower end of the femur of *Plesianthropus*, if considered entirely isolated from the circumstances of its discovery, would probably be referred by most anatomists to *Homo*. It is a small bone (and thus harmonizes with all the other limb bones also ascribed to the Australopithecinae), but relatively robust. The obliquity of the shaft comes within the human range and this feature suggests an adaptation to an erect posture perhaps almost as fully developed as it is in modern man. This possibility received further support from the contour of the patellar articular surface (which slopes rather abruptly into a prominent lip laterally), and from the proportionate sizes of the two condyles. It may be noted that these characteristics of the Australopithecine femur are entirely consonant with the evidence of an upright, or approximately upright, posture derived from a consideration of the position of the foramen magnum on the base of the skull, and also with the climatological evidence that the Australopithecinae must have been adapted to a terrestrial life in an arid environment.

If all the facts enumerated above are taken into consideration (and it is of the utmost importance that they should *all* be considered together as components of a total pattern), they only serve to reinforce the conclusions reached by Dart and Broom (on the basis of much more prolonged studies of their material) that the Australopithecinae represent an extinct group of the Hominoidea which must be associated with the line of hominid evolution rather than with that leading to the modern large apes, and

which almost certainly were closely related to (and perhaps survivors of) the ancestral stock from which *Homo* was derived.

The fossil hominoid material derived from lower Miocene deposits in Kenya (most of which has been discovered by Dr. Leakey and Dr. MacInnes) is interestingly complementary to the australopithecine material from South Africa, for while the latter throws important light on the relationship of the human stock to other groups of the Hominoidea, the former is of paramount importance for the light it throws on the evolutionary radiations of the Hominoidea as a whole and on their ultimate derivation from still more primitive types of primates. Two principal genera of fossil apes from Kenya have hitherto been recognized—*Proconsul* and *Limnopithecus*—which are represented by a number of specimens. The importance of the *Proconsul* material rests on the fact that it represents the only large fossil hominoid hitherto discovered in *Lower* Miocene deposits, and that it includes a (practically) complete mandible and considerable facial fragment and an immature jaw which indicates clearly the tooth succession. In the proportions, relative sizes and cusp patterns of the lower molars, *Proconsul* shows quite close agreement with *Dryopithecus*. The upper molars, however, are characterized by a marked development of the internal cingulum which may be elaborately crenated. The canines are relatively large. By contrast, the incisor teeth are small and in certain features surprisingly human in appearance. The reduced development of the incisor series has important repercussions on the appearance of the mandible as a whole. As a result of it the alveolar prognathism is considerably less pronounced than in modern apes, the horizontal rami of the mandible (together with the molar-premolar series) converge quite strongly towards the symphysis instead of being disposed in approximately parallel formation, and the 'simian shelf' is absent. It is possible to suppose that the characteristic features of the mandible of the modern African representatives of the *Pongidae* may have been derived from the *Proconsul* type by an enlargement of the incisor teeth and a resulting broadening of the symphysial region. If this assumption is correct, it follows that the 'simian shelf' is not a primitive simian character—it is simply an expression of the evolutionary hypertrophy of the incisor series, serving to fill in the space which is left by the consequent separation of the front ends of the mandibular rami and which is not required for the accommodation of the musculature in the floor of the mouth. Whether *Proconsul* can be regarded in an ancestral relationship to the chimpanzee (as suggested by Hopwood) depends partly on the

interpretation of the significance of the internal cingulum of the upper molars of the fossil ape. This striking feature is perhaps a specialization of a slightly aberrant kind. A preliminary survey of the teeth and jaws of *Proconsul* suggests that, in spite of its remarkably generalized characters, this extinct hominoid was already somewhat specialized in the direction of the large Pongidae. However, this conclusion is entirely provisional, for it has yet to be determined with certainty how far such specializations may have found expression even in the ancestry of those modern representatives of the Hominoidea who no longer show them.

Limnopithecus is remarkable for the fact that, judged by criteria of dental morphology, it should be probably included in the Hylobatinae, a subfamily of the Pongidae which to-day is confined to south-east Asia. However, the dentition shows remarkable resemblances to the genera *Propliopithecus* (Oligocene) and *Pliopithecus* (Miocene), particularly the former, and it seems probable that, as suggested by MacInnes, further comparative studies will establish the phylogenetic link between all these fossils. Preliminary studies indicate that *Limnopithecus* was rather more specialised than *Propliopithecus* in the development of a stronger canine and a sectorial form of the lower anterior premolar.

Important limb bone material attributable to the fossil Miocene apes of Kenya has recently been discovered by Dr. Leakey. Some of this has been already described by Dr. MacInnes, who points out certain differences from the corresponding bones of the modern anthropoid apes. It is hoped later to make more detailed comparative studies of this valuable material.

It has become very clear that the Lower Miocene deposits of Kenya are particularly rich in fossil primate material. It now becomes a matter of very great importance that these sites should be exploited to the full as soon as possible, for it seems certain that a systematic exploration will bring to light material in sufficient abundance to fill several of the serious gaps which still exist in our knowledge of the early evolution of the Hominoidea, *i.e.* the zoological group which includes man and the anthropoid apes.

OBSERVATIONS SUR LA PHYLOGÉNIE DES PRIMATES ET L'ORIGINE DES HOMINIENS

C. Arambourg

L'ordre des Primates comprend, au point de vue systématique, trois subdivisions essentielles, qui ont rang de sous-ordres :

Les Prosimiens (ou Lemuriens)
Les Simiens (ou Singes)
Les Hominiens.

Ces trois subdivisions correspondent à trois types d'organisation distincts qui diffèrent entre eux par leur degré de specialisation dans le sens du développement cérébral, par leur comportement différent vis-à-vis du milieu extérieure et par leur mode de vie.

Anatomiquement, ces différences se traduisent par toute une série de dispositions caracteristiques parmi lesquelles les plus immédiatement accessibles sont :

1. La capacité et la morphologie cranienne ;
2. La structure de la dentition.

La première correspond au degré de développement du cerveau ; la seconde est en rapport avec le mode de vie et le régime alimentaire. On sait toute l'importance qu ' attachent les paléontologistes à la morphologie de la dentition des mammifères, car celles-ci reflète directement, sur le plan physiologique, le comportement et les besoins de ces animaux. Or les caractères de la dentition des Simiens et des Hominiens présentent des différences fondamentales qui correspondent à des modes de vie et à des besoins physiologiques absolument différents.

La dentition des Simiens, en effet, qu'il s'agisse des Cynomorphes (les singes ordinaires) ou des Anthropomorphes (les grands singes) est caractériseé par le grand développement de la partie coupante de la machoire par rapport à la partie broyente. Chez ces animaux l'arcade dentaire a la forme d'un U, dont la partie antérieure, projeteé en avant, est formeé des incisives, canines, et (à la mandibule) premières prémolaires qui sont toutes des dents tranchantes et constituent, en même temps qu'un instrument, une arme de défense (les canines notamment). Cette structure existe même chez les jeunes où la première molaire caduque inférieure est elle-même pointue et tranchante.

Chez les hommes, l'arcade dentaire est parabolique, sa partie antérieure est raccourcie et les seules dents tranchantes se reduisent aux incisives. Les prémolaires inférieures elles-mêmes sont tuber-

culeuses et la première molaire caduque est molariseé et formée de quatre tubercules mousses.

Il y a donc avec la dentition des Simiens une différence fondamentale qui correspond, chez l'homme, à la fois à une réduction des moyens de défense, à un régime alimentaire distinct et, par suite, à un mode de vie et à des besoins physiologiques tout différents.

On comprend donc toute l'importance que présentent ces caractères lorsqu'il s'agit de situer une forme fossile dans la lignée simienne ou dans la ligneé humaine.

C'est la méconnaissance de ce fait fondamental qui incita certains paléontologistes, à la suite d'Abel, à considérer l'*Australopithecus* comme un chimpanzé jeune et il fallut plusieurs années pour réparer cette erreur en montrant, comme le fit Bennejeant en France, que la première molaire caduque de ce fossile etait de type humain.

Ceci posé, je désirerais attirer (ainsi que je l'ai fait déja) l'attention sur une découverte qui me parait importante pour fixer l'origine du rameau humaine dans la série des Primates.

Il y a quelques anneés, parmi le remarquable matériel découvert dans le gisement Miocène de Koru, Hopwood a décrit deux fragments de mandibules d'un petit singe voisin des gibbons par sa taille et par la structure de ses molaires ; il l'a nommé *Limnopithecus legetet*. L'un des fragment comprend la première et la deuxième molaire de lait et il est visible d'après la description d'Hopwood et d'après la moulage que j'ai examiné que la première molaire caduque est molarisée, quadrituberculaire et de type humanoïde ; elle ressemble beaucoup, aux dimensions près, à celle de l'*Australopithecus*.

Cette découverte, a l'epoque où elle fut faite, ne parait pas avoir retenu specialement l'attention des paléontologistes, car, à ce moment, ainsi que je l'ai rappelé, l'Australopithèque passait encore, aux yeux de certains, pour un chimpanzé.

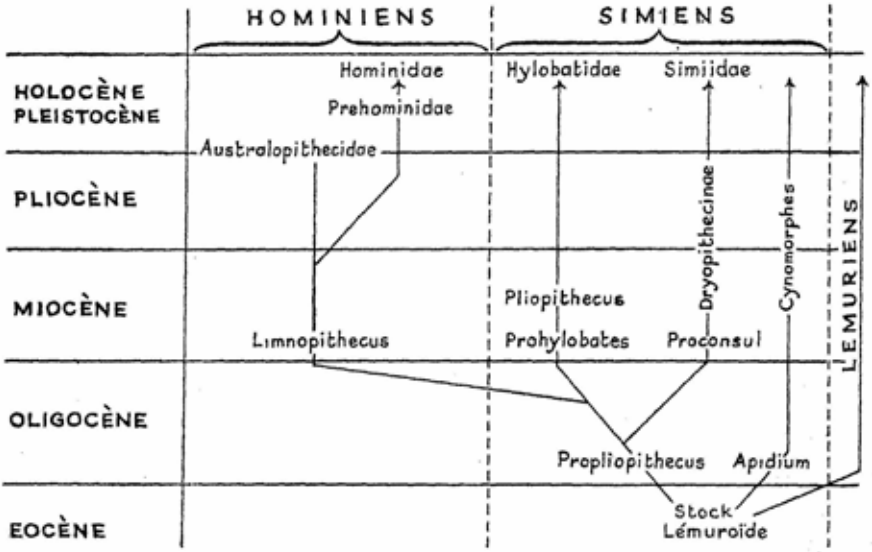
Cette découverte demande évidemment confirmation par la découverte ultérieure de matériaux similaires et plus complets, car il faut toujours, en matière paléontologique, lorsqu'il s'agit des spécimens uniques, se demander s'il ne s'agit point d'un cas tératologique ou d'une variation individuelle exceptionelle.

Mais si mes vues sont exactes, la découverte de *Limnopithecus* prend un valeur considérable, car ce fossile appartient au Miocène inférieure ; la faune qui l'accompagne comprend *Brachyodus*, *Bunolistriodon*, *Pliohyrax*, *Palaeochoerus*, etc., qui le datent d'une façon certaine.

Il est donc le plus ancien représentant de l'ordre des Primates qui présente dans sa dentition une structure de type humain et qui annonce celle de l'Australopithèque ; il est, d'autre part, voisin des gibbons, eux-memes déja représentés en Afrique dans le même niveau stratigraphique.

Il correspond donc, dans la série évolutive, à une forme située près du point d'où le rameau des Hominiens s'est détaché de celui des autres Primates, détachement que l'on doit donc faire remonter au moins au début du Miocène ou à la fin de l'Oligocène.

Le Tableau schématique ci-dessous concrêtira les vues qui viennent d'être exposeés.



SUMMARY

Human and simian dentitions show fundamental differences in the form of the jaw and of the incisor, canine, and first lower premolar and milk molar teeth, which correspond to absolutely different modes of life and physiological requirements. These characters are of the greatest importance for assigning a fossil type to either the human or the simian lineage. By these criteria, *Australopithecus* must be ranged with the humans and not with the great apes. *Limnopithecus* from the lower Miocene of Kenya also appears to have a first lower milk molar of humanoid type as in

Australopithecus. If this is confirmed, *Limnopithecus* must be regarded as the oldest known member of the human lineage. In other respects, *Limnopithecus* approaches the gibbons, and may therefore be placed close to the point of separation of the human and simian branches. This separation must then have taken place not later than the beginning of the Miocene.

Tuesday, January 21st

A CULTURAL AND RACIAL PARALLEL IN TWO KALK BAY ROCK-SHELTERS

M. R. Drennan

In a Preliminary Report on the Archaeologyof the Fish Hoek—Noord Hoek Valley, Mr. A. J. H. Goodwin summarised for the meeting of the British Association which was held in South Africa in 1929 the results of certain excavations undertaken in this area by the late Mr. Peers and his son. This communication included an account of the various stages of excavation work which the Peers had done in a rock shelter situated above the Kalk Bay harbour and marked in their notes as ' Shelter, B-102 '.

From his account of the excavation it would appear that the floor of the shelter was occupied to a depth of 5 feet by shell debris, careful sifting of which produced, in addition to several mullers, a few bored shells, a number of toe and finger bones and fragments of an infant skeleton which had been disturbed by previous excavators.

Below the overburden of shell the excavators encountered a sterile layer of mountain sand about 1 foot in thickness, and beneath this there was a compressed layer of dark sandstone grit about 18 inches in thickness and containing chert flakes, crescents, burins, lance-heads, scrapers and cores. The material, according to Mr. Goodwin, showed ' marked affinities with Hewitt's Howieson's Poort material, probably a contact industry marking the mixture of Still Bay and Neoanthropic types '. Mr. Goodwin also pointed out how the absence of shells indicated a land type of subsistence for the exponents of this culture which is in sharp contrast to the shell-fish diet of the succeeding culture. There was, however, a notable absence of any kind of bones in this horizon.

A specially interesting result of this excavation by the two

Peers was the finding of a fragile and somewhat broken skeleton in the sterile intervening layer and at a depth of 6 feet below the modern floor. A flat stone had been laid over the fully flexed skeleton and this had unfortunately dented the back of the skull. At the time of excavation it was assumed that it was the skeleton of a member of the San race and that it had been buried by the midden folk into the sterile sand layer.

The skeleton was photographed *in situ*, but it was not examined methodically, and when both members of the Peers team died it was lost sight of and only recently located as an undisposed-of item in the Peers' collection.

Early in 1945 the Cape Branch of the S.A. Archaeological Society sponsored the excavation of a rock-shelter adjoining B-102 which Mr. Peers had marked as C-103.

During the excavation members of the party visited the adjoining shelter referred to above, that is to say B-102, and in a heap of sifted material in front of this cave they found a newspaper parcel containing some very fragmentary human bones. These were submitted to me and I was able to reconstruct from them the lower third of a particularly robust human thigh-bone. It was quite clear that it must have belonged to an individual with a stature of about 5 ft. 8 in., and that he could not have been a member of the Bush race.

An enquiry into the original excavation of this cave was instituted and Mrs. Peers succeeded in locating the skull which her husband had excavated from cave B-102, and she kindly presented it to me for examination. Unfortunately in spite of the fact that Mr. Peers had treated the skull with shellac it had deteriorated during the long storage and was in a very fragile condition. It is obvious also that it has been somewhat distorted by the long pressure of the stone and overburden upon it, and parts such as the right orbit, through which big roots were found growing when it was discovered, had been destroyed. The jaws and teeth were, however, in a perfect condition, and I have made an attempt to reconstruct the cranium.

The blackened condition of the skull is very similar to that of the massive fragmentary limb-bones discovered outside the cave, and it would appear that they must have belonged to the same individual, especially as only one skeleton is in this condition. In any case the skull can be identified from the photograph which was taken of it *in situ*, and it is not that of a Bushman. There is no doubt about the position in which it was found, namely in the sterile layer of sand which lay under 5 feet of shell midden and

over 18 inches of the contrasting facies of a Howieson's Poort regime. It is now known also from a subsequent excavation undertaken by members of the S.A. Archaeological Society that bedrock was reached thereafter, so that we have only got to consider what one might regard as two contiguous and contrasting colours of the local archaeological spectrum.

I will point out presently the directions in which Skull B-102 is in many ways a corresponding morphological antithesis to the Strandloper type of Bushman which is usually found in association with the kitchen-midden culture. The interesting question arises as to whether the original investigators were correct in assuming that both types belong to the upper horizon, or whether it is possible that the primitive robust type from B-102 could be associated with the older Howieson's Poort culture.

We know from the results of excavations at Oakhurst and at Matjies River that individuals with a more robust Hottentot-like structure practised the Wilton culture, and that Bushmen and Bush-Hottentot and probably also the pedomorphic types are associated with various phases of the Later Stone Age. It is possible also that there were primitive survivals from the Middle Stone Age into the earlier part of the Later Stone Age. It may be that B-102 was such and that this new element which has hitherto been 'foreign' to the Later Stone Age was buried back by the Midden people towards what I consider was his more appropriate stratum. But although this is the conventional outlook of stratigraphists, I would point out that it is very difficult to scrape out a grave through shells without a good number of the shells rolling into the grave and constituting thereafter part of the filling. Judging from the description and from the photograph there were no shells but only clean earth round the skeleton. It is quite possible that this individual could have been placed superficially on the Howieson's Poort stratum and then covered by a flat stone and a heap of clean earth collected before there were any shells about.

At any rate I hope to show that the skeleton of this individual links palaeanthropic with neoanthropic man in much the same way as the Howieson's Poort culture links the Middle with the Later Stone Age. For his affinities in a backward direction I need only mention the extreme lowness of the cranial vault, and his massive neanderthaloid lower jaw (see Fig. 1). This latter is one of the most primitive human mandibles which have so far been discovered in Southern Africa, its nearest equivalents being the Springbok Flats mandible and the Kalomo mandible from Northern Rhodesia. This mandible is in fact intermediate in size between the

Mauer jaw and that of the Bushman, and it is noteworthy that these three jaws all conform to the same pattern.

Although I have alluded to the possibility of this individual having been a contemporary of the last days of the Howieson's

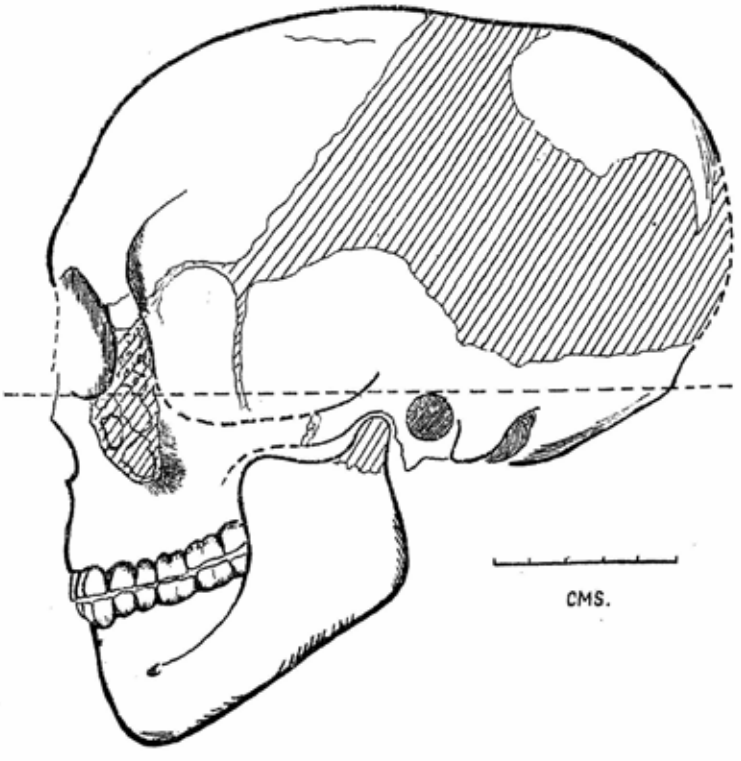


FIG. 1. Skull B–102

Poort culture, it is not a matter of great moment as to whether this particular individual lived in what we call Middle or in Later Stone Age times. The main thing is that he appeared in a contact layer between these two periods, and that he shows morphological characters of a very primitive nature which would of themselves assign him to this linking position. Like the Howieson's Poort culture he is a transition between older and newer forms.

What is equally interesting is the fact that he appears to have left his racial mark to a certain extent on the later Strandloper population in much the same way as the Howieson's Poort culture has influenced the succeeding one. In the course of excavating the adjoining shelter, C-103, members of the Cape Branch of the

S.A. Archaeological Society discovered the skeleton of a young adult male Strandloper. The skeleton was found at a depth of 4 feet in a dark layer of soil underlying the kitchen-midden layer. It was noted, however, by the excavators that it was not an ordinary

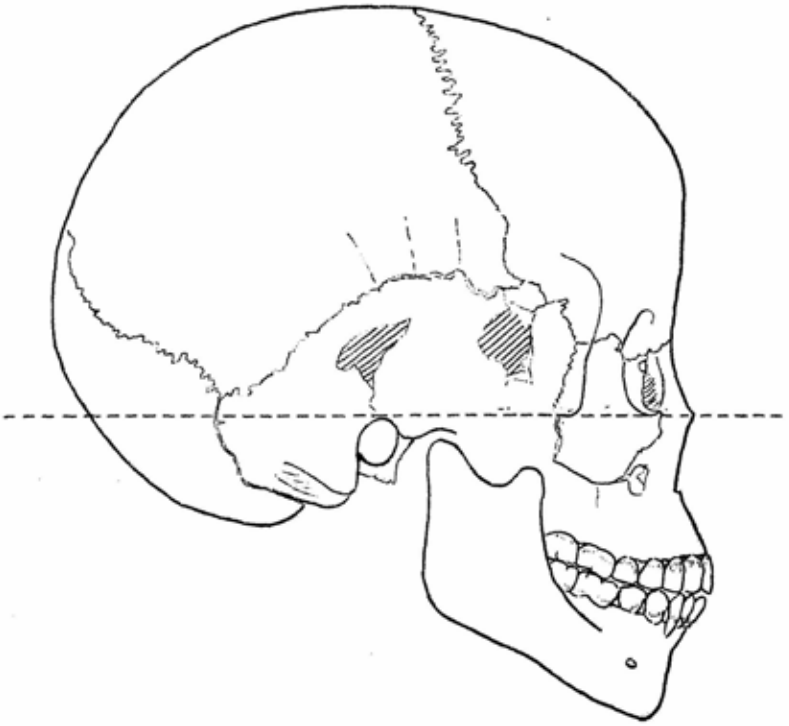


FIG. 2. Skull C–103

burial that they were dealing with, in that the natural position of the bones had been disturbed and many of the limb-bones were missing. Those remaining were incomplete and it was discovered later that these bones and part of the skull had been gnawed by some large carnivorous animal. In appearance the skull was that of a typical Strandloper, except that it had very big and prominent teeth and these gave the skull a prognathous look which is unusual in a Bushman (Fig. 2).

The presence of this macrodontic dentition, which is the only unusual feature of this skull, is in striking contrast to the characteristic microdontic dentition of the Bushman, the race to which

this skull belongs. In seeking for an explanation of this feature it is important to note that the dentition of the primitive skull from the adjoining cave B-102 is also macrodontic. These two dentitions have already been discussed by me elsewhere (1), so that I shall content myself with stating the conclusion which I reached in my previous paper. This was to the effect that the presence of big teeth in the Strandloper C-103 is best explained by the most likely possibility that he inherited them, if not from B-102, at least from this big-toothed type. That is to say that just as certain cultural elements have been handed down from the Howieson's Poort people to the Kitchen-midden folk, so they may have passed on some of their genes, in this case those for teeth, to one at least of their succeeding Strandlopers.

Measurements

Both skulls have suffered considerable damage to their bases so that it has not been possible to take all the important measurements for comparative purposes. I have, however, appended those dimensions about the accuracy of which there is very little doubt. From these figures and from an examination of Fig. 2 it will be seen that the skull from shelter C-103 is that of a more or less typical Bushman.

A study of the measurements and drawing (Fig. 1) of the skull from shelter B-102 shows the marked nature of the contrast between it and the more recent skull. On account of its much greater robustness I consider that it is suitably labelled as a Boskopoid skull, using this term in the sense of denoting those more massive pre-Bushman and especially pre-Hottentot types of which quite a number have already been found.

The special feature of this skull is its heavy jaws, in particular its mandible. I have already described it as neanderthaloid, which is an appropriate term in that it is as robust as any of the ordinary Neanderthal jaws. It lacks the very receding chin of this group, but it has much more bone in this region, when measured circumferentially, than any of them including the Mauer jaw. In the region of the mental foramen its height is the same as that of the Mauer jaw, and it is only 2 mm. less in thickness. It is because of the special squatness of the ramus of the mandible that I have instituted a comparison with that of *Homo heidelbergensis*. Mandible B-102 has an even more primitively square ramus than the Mauer jaw with a ramus breadth-height index of 93, whereas that of the latter jaw is 87.

Chief measurements of :

Skull C–103.—L. 170, B. 134, CI. 79 ; BB. 130?, Aur. H. 110, HI. 76 : NP. 62 : Nh. 45, Nw. 27, NI. 60 : Oh. 31, Ow. 41, OI. 76 : CC. 1235 : Ml. 95, Mw. 103, MI. 92 : Rb. 32, Rh. 40, RI. 80.

Skull B–102.—L. 185, B. 140, CI. 76 ; BB. ?, Aur. H. 103, N.P. 76 : Nh. 55, Nw. 30, NI. 54 : Oh. 37, Ow, 43, OI. 86 : CC. 1195 : Ml. 105, Mw. 120, MI. 88 : Rb. 43, Rh. 46, RI. 93.

REFERENCE

1. 'A macrodontic Bushman skull in relationship to a Boskopoid skull with a similar dentition and large jaws.' By M. R. Drennan, S.A. Dental Journal, Vol. XIX, No. 8, Aug. 1945.

Wednesday, January 22nd

SYMPOSIUM ON FOSSIL MAN IN AFRICA

HUMAN CRANIA OF THE MIDDLE STONE AGE IN SOUTH AFRICA

L. H. Wells

The Middle Stone Age of South Africa comprises a group of cultures based on a 'Levalloisian' (facetted striking platform) flake technique, which intervenes between the hand-axe cultures of the Early Stone Age and the Late Stone Age blade cultures. It seems to occupy and to end simultaneously with the terminal phase of the Pleistocene.

Human remains which have been assigned to the Middle Stone Age are few compared with the abundance of Late Stone Age skeletal material. Some have been attributed to this period on very nebulous grounds, and even the best authenticated associations have admitted of some doubt. The available crania have never been studied as a group apart from specimens of later date. In preparing this review, I have been able to examine at first hand almost all the specimens considered.

Credentials of the Crania

1. *The Florisbad Skull* (Dreyer, 1935). Although Dreyer (1938) considers this specimen to antedate part of the Early Stone Age hand-axe culture, many South African archaeologists attribute it to an early phase of the Middle Stone Age.

2. *The Tuinplaats (Springbok Flats) Skeleton* (Broom, 1929). Van Riet Lowe (1929) established that these remains were derived

from an advanced Middle Stone Age (Pietersburg) horizon, and the weight of evidence is against their having been subsequently intruded into this deposit.

3. *The Border Cave* (*Ingwavuma*) *Remains* (Cooke, Malan and Wells, 1945). There is adequate evidence that the adult skull from this cave came from the Middle Stone Age deposit and could not have been buried later than the end of this period. It probably belongs, like the infant skeleton from the same deposit, to the latest phase of the Middle Stone Age represented in this cave ; this phase is more refined than the typical Pietersburg which it overlies, but less advanced than the South African Magosian.

4. *The Boskop Skull* (Haughton, 1917). This was the first genuinely fossilised human cranium to be recognised in South Africa. Although its precise antiquity was not established at the time, there is now good evidence that the skull was derived from a Middle Stone Age horizon comparable with that which yielded the Tuinplaats skull.

5. *The Skildergat* (*Fish Hoek*) *Skeleton* (Keith, 1931). This specimen has hitherto been regarded as unquestionably of Middle Stone Age (Stillbay) date. Goodwin (1946) now states that it should be assigned to the final (Howieson's Poort) phase of the Middle Stone Age, or even to the base of the Late Stone Age deposits.

6. *The Matjes River* (*Knysna*) *Crania* (Keith, 1934 ; Dreyer, Meiring and Hoffman, 1938). In this cave Dreyer (1934) assigned to the Middle Stone Age (Mossel Bay) a thickness of nearly twenty feet of deposits containing abundant human remains. Hewitt (1934) suggested that the upper portion of this stratum really belongs to the Late Stone Age. I understand from Professor Dreyer that he accepts this interpretation and now regards only the lowest portion of the deposit as Middle Stone Age. This horizon has yielded three crania which may be regarded as coeval with it ; they are distinguished from those found in the higher levels by a different funerary ritual (Dreyer, 1934). Keith (1934) described two of these skulls (M.R.1. and M.R.2) ; the third (M.R.X.) has received only a brief notice by Dreyer, Meiring and Hoffman (1938).

7. *The Cape Flats Skull* (Drennan, 1929). This site has yielded remains ranging in age from the Middle Stone Age or even earlier up to modern times. The inference that the skull may date back as far as the Middle Stone Age is based upon its advanced fossilisation compared with other human fragments from the site.

8. *The Zitzikama Crania* (Dart, 1923 ; Gear, 1926). Artefacts

of Middle Stone Age type are present in the collections from the Zitzikama group of caves, but the available records do not establish whether any human remains were associated with them. Some of the cranial fragments described by Gear (1926) are closely similar in condition to the oldest Matjes River specimens and therefore deserve consideration. Others, including the skull described by Dart (1923), are in a much fresher condition and seem very unlikely to be as old as the Middle Stone Age.

9. *The Kalk Bay Skull* (Drennan, 1945). Professor Drennan assigns this specimen to the same (Howieson's Poort) phase as is now suggested for the Skildergat skeleton.

Survey of Characters of the Crania

The crania which can plausibly be attributed to the Middle Stone Age have been recovered from sites very widely dispersed over South Africa, and must also be distributed over a considerable range of time. While the Florisbad skull seems to belong early in this period, if not even before it, all other datable specimens belong to more recent stages. The Border Cave skull is later than that of Tuinplaats; those of Skildergat and Kalk Bay are perhaps still later. The Boskop skull may be as old as the Tuinplaats skull, and the Cape Flats skull as old as or older than the Skildergat skull, but this remains uncertain. Nor is it yet possible to fix the horizon of the Matjes River crania relative to those already mentioned.[1] It is therefore not possible to classify these crania completely on a chronological basis.

The Florisbad skull may be the first considered, since it is certainly the oldest and also stands morphologically apart from the others. The modelling of the zygomatic and infraorbital regions is essentially 'sapient'; the supraorbital margins are massive and form an almost continuous torus, but are 'Australoid' rather than 'Neanderthaloid' in character. On the other hand, the extraordinary breadth and flatness of the frontal region places the skull far outside the limits of variation usually assigned to *Homo sapiens*. It thus occupies a position astride the boundary of the modern species.

The later Middle Stone Age skulls all belong within the species *Homo sapiens* as it is usually defined. They vary far too much to be typified by any individual specimen, such as the Boskop skull; it is

[1] In a paper which appeared after this communication was read, Dreyer (1947) claims that the Mossel Bay industry in the deepest layer of the Matjes River Cave represents a very early phase of the Middle Stone Age. This view implies that the Matjes River crania may be older than any of the others apart from the Florisbad skull.

therefore inaccurate to describe the Middle Stone Age human type as 'Boskopoid' or to assume that any remains similar in physical type to the Boskop skull date back to this period. But in spite of this diversity, all the skulls are linked by a network of morphological similarities. This was demonstrated for the majority of these specimens by Galloway (1937), and is also true for those not considered by him.

A clue to the mutual relationships of these crania is provided by their varying degress of pedomorphic specialisation. The Tuinplaats and Border Cave skulls have few or no pedomorphic features; those of Boskop, Skildergat Cave, and Matjes River Cave, are all distinctly pedomorphic in some respects.

The non-pedomorphic character of the *Tuinplaats* skull is indicated by its ovoid cranial contour, large but not excessive cranial capacity, relatively large mastoid processes, long prognathic face and enormous mandible. The frontal and supraorbital regions are moderately broad, and the glabella and superciliary eminences, though not massive, are saliant. At its lateral extremity the superciliary eminence merges without any definite break into the lateral supraorbital margin, suggesting an extremely refined supraorbital torus. A point not brought out in previous descriptions is the form of the nasal process of the maxilla, which shows the nasal bridge to have been very flat as in the modern Bushman. From the associated skeletal remains, this individual was of tall stature and robust build.

In the *Border Cave* skull the brain case, so far as it is preserved, is closely similar in size and general form to that of the Tuinplaats skull. There are considerable differences however in the frontal region, which is unusually broad with a decided median ridge, and carries a continuous and robust supraorbital torus. The associated mandible suggests that the face was shorter and less prognathic than that of the Tuinplaats skull. This and the short though very broad mastoid process are the only features suggesting a tendency to pedomorphism in the Border Cave skull, and these are offset by the powerful supraorbital torus. Despite the general resemblance between the Border Cave and Tuinplaats skulls, they differ enough to make it doubtful whether they could be assigned to a single physical type, unless it were either composite in origin or remarkably plastic in structure. They may be more aptly regarded as divergent descendants of an immediate common ancestor.

The *Boskop* skull is clearly distinguished by its extreme cranial length and breadth and correspondingly enormous cranial capacity, by the prominent parietal eminences and consequent pentagonoid

cranial form, and by the relatively small, infantile mastoid process. In spite of its size and robustness of build this skull is therefore strongly pedomorphic; Dart (1940) has aptly described it as a *giganto-pedomorphic* type. Nevertheless the similarities in detail noted by Galloway (1937) between the Boskop and Tuinplaats skulls suggest a relationship between the two in spite of their diverse specialisation. It is at least possible that the Boskop type is a pedomorphic descendant of the same ancestral stock as the Tuinplaats skull.

The unquestionably pedomorphic character of the *Skildergat Cave* skull is clearly demonstrated by the disproportionately small face compared with the large capacious braincase, as well as by such details as the diminutive mastoids. It differs strikingly from the Boskop skull in cranial form, the greatest breadth being low down in the temporal region, so that the parietal eminences do not determine the cranial contour. Moreover, the Skildergat skeleton though robust was of short stature. It seems that despite its large skull this is really a *pygmaeo-pedomorphic* type (Dart 1940).

The structure of the frontal region in the Skildergat skull has not been sufficiently stressed in previous descriptions. It is relatively broad, with a strong median ridge, and bears a continuous though slender supraorbital torus. In view of the strongly pedomorphic character of the Skildergat skull, this can easily be interpreted as a refinement of the massive Border Cave torus. At the same time, Schepers (1941) has observed that the Skildergat mandible may be regarded as a diminished descendant of that of Tuinplaats. These observations suggest that the Skildergat skull is the pedomorphic descendant of a type which combined the most characteristic features of the Tuinplaats and Border Cave skulls.

Of the *Matjes River* crania, M.R.1 has in my opinion its nearest relationships with the Skildergat skull. It is distinguished, as Keith has pointed out, by the extremely narrow forehead and excessively prominent median frontal ridge, giving it a trigoncephalic cranial contour. This exaggerates a feature strongly developed in the Skildergat skull, and less strongly in the Border Cave and even the Florisbad skulls. In M.R.1 the supraorbital region (reconstructed by Dreyer from fragments not available to Keith) is similar in development to that of the Tuinplaats skull. The juvenile skull M.R.2 is unquestionably closely related to M.R.1; Keith is quite justified in inferring that they are members of one family group. Nevertheless in some respects the child's skull more closely approaches that of Skildergat, emphasising the strongly pedomorphic character of the latter.

The difference in supraorbital modelling prevents M.R.1 from being regarded as a direct precursor of the Skildergat man ; the relationship between the two is comparable to that between the Tuinplaats and Border Cave crania. This is consistent with an origin of both the Skildergat and M.R.1 types from the same ancestral stock as those of Tuinplaats and Border Cave.

In the remaining Matjes River specimen, M.R.X, we are confronted with a different type, which Dreyer, Meiring and Hoffman (1938) have correctly recognised as essentially Bushman. If the horizon of this find is truly Middle Stone Age, it is the oldest dated Bushman skull so far discovered. The distinguishing features of this type are the short cranial length, prominent parietal bosses and pentagonoid cranial form, short face and generally infantile structure ; it is *pygmaeo-pedomorphic* (Dart 1940).

Many authorities have suggested that the Bushman type has been developed from either the Boskop or the Skildergat pedomorphs. When the direct effects of pedomorphism are excluded, the Bushman skull resembles that of Tuinplaats as much as it does those of Boskop and Skildergat. I suspect therefore that the pygmaeo-pedomorphic Bushman type has developed independently from the same non-pedomorphic stock which gave rise to the Boskop and Skildergat types.[1]

The 'Australoid' *Cape Flats* skull appears as an isolated type, which Broom (1941) has imagined to represent an independent line of descent from such an ancestor as the Florisbad skull. Nevertheless from its general characters it seems possible that the Cape Flats skull is related to the non-pedomorphic Tuinplaats type.

Of the *Zitzikama* remains, those which appear to be the oldest and may possibly belong to the Middle Stone Age are fragmentary. Although these remains have previously (Gear, 1926) been compared with the Boskop skull, they seem really to be more closely related in cranial form and supraorbital development to the Tuinplaats and Border Cave skulls.

The *Kalk Bay* skull does not appear, from Professor Drennan's account, to be closely related to the Skildergat skull. So far as it is pedomorphic in character, it more nearly resembles the Boskop skull, but it seems also to have affinities with that of Tuinplaats.

Discussion

I consider that the complex interrelationships of the later Middle

[1] Dreyer (1947) regards M.R.1 as ancestral to the Bushman type. This view appears hardly consistent with the close chronological proximity of M.R.1 and M.R.X.

Stone Age crania are best explained by regarding them as divergent specialisations of a not very distant common ancestral stock. This ancestral type was almost certainly non-pedomorphic, and probably decidedly gerontomorphic. Nevertheless it must have been very plastic, with a strong tendency to pedomorphic developments. It seems that pedomorphic specialisation may have taken place independently in at least three groups derived from this ancestral stock, associated with either exuberant or retarded growth. These three groups are represented by the Boskop, Skildergat, and M.R.X (Bushman) crania.

If the non-pedomorphic derivatives of the ancestral stock, such as the Tuinplaats and Border Cave crania, and perhaps the Cape Flats specimen, have to some extent preserved its features, this ancestral type may be credited with a moderately large ovoid braincase, a broad frontal region with a massive supraorbital torus, a long prognathic face, flat nasal bridge and very large mandible. The type thus visualised corresponds in many respects with the Florisbad fossil, the only South African skull of early Middle Stone Age or earlier date yet known. This skull may therefore stand close to the ancestral stem of the later Middle Stone Age types. That it actually represents this ancestral type may be doubted. The extraordinary breadth and flatness of the frontal region suggests that it is rather an aberrant offshoot of the ancestral stock.

The interpretation which I have proposed represents a *via media* between the views of such authors as Keith (1934), to whom ' Bushman ', ' Boskopoid ', and 'Australoid ', are variations within a single type, and of those who, like Broom (1941), regard them as so many distinct and unrelated lineages. In suggesting that all the human types so far assigned to the Middle Stone Age can be traced to a single ancestral type, I do not exclude the possibility that other types, as yet unrecognised, did reach South Africa during this period.

Much of the diversity among Middle Stone Age skulls may be due to local evolution in partially isolated communities. But these seem at times to have mingled and hybridised, entangling still further the complex web of relationships.

In the Late Stone Age population almost all of the morphological types differentiated in the Middle Stone Age can be recognised. Dart and other workers have demonstrated the persistence of the giganto-pedomorphic Boskop type, Broom that of the Skildergat, Tuinplaats, and heavy-browed 'Australoid ' types. But most startling is the evidence afforded by the Matjes River

skull M.R.X. that the true Bushman type, hitherto regarded as characteristic of the Late Stone Age, was already present in the Middle Stone Age. Recent archaeological work has tended to bridge what formerly seemed a complete break between these two periods; the extent to which physical types survived from the earlier to the later period may well prove to have a very significant bearing on this.

ACKNOWLEDGMENTS

I wish to thank Professor R. A. Dart for encouraging me to undertake this study and for his valuable suggestions. For the opportunity of examining the crania discussed in this paper I have to thank Dr. R. Broom, Professor T. F. Dreyer, Professor M. R. Drennan and the Directors of the Cape Town, Port Elizabeth, Bloemfontein and Pretoria Museums. I must also thank Professor Dreyer, Professor C. van Riet Lowe, Dr. J. Hewitt, Mr. A. J. H. Goodwin and Mr. B. D. Malan for their guidance in determining the archaeological horizons of these specimens.

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THE AGE OF THE EYASSI SKULL

L. S. B. LEAKEY

SUMMARY

The Eyassi skull, which was found by Dr. Kohl Larsen on the shores of Lake Eyassi in 1935, was briefly described by myself in *Nature*, vol. 128, p. 1082 in 1936. It was clearly stated in that article that on the available evidence, both faunal and cultural, the Eyassi skull was in all probability of Upper Pleistocene age. The associated culture was Levalloisian, although a few derived and rolled hand-axes had been found in the same deposits.

The views which I expressed in *Nature* were not accepted by many people, who argued that, since the skull was what they called 'very primitive' and had features which recalled the *Pithecanthropus* group, it must be of greater age than the Upper Pleistocene.

In 1939 Dr. Weinert of Kiel described the skull, giving it the generic name of *Africanthropus*.[1] He assigned it to a Lower Pleistocene date, using the evidence of the so-called 'primitive' characters of the skull itself as the criteria of its age and ignoring both the faunal and the cultural evidence.

[1] This name is preoccupied by *Africanthropus* Dreyer, 1935 (Florisbad skull).

In 1938 I visited the site where the skull was found, accompanied by Mrs. Leakey and by Mr. Reeve, a geologist of the Geological Survey of Tanganyika Territory. This visit was made possible by special grant aid from the Royal Society. Scientific reports giving the results of this visit were published in the Journal of the East African Natural History Society (June 1946). A brief summary of the results of the re-examination of all the evidence for the age of the Eyassi skull is as follows :

1. The Upper Pleistocene age is confirmed geologically, palaeontologically and from the point of view of the associated Stone Age culture.

2. There are some rolled and derived fossils of Middle Pleistocene age, as well as rolled and derived hand-axes in the deposits from which the skull was obtained, but these cannot be used to date the skull, which is unrolled, and which clearly belongs with the unrolled artefacts and unrolled fossils.

3. The discovery of the Eyassi skull confirms the evidence from Kenya that during the Upper Pleistocene (Gamblian pluvial period), *Homo sapiens* as represented by the skeletons from Gamble's Cave, was contemporary with a species of the *Palaeoanthropidae*.

The validity of creating a new genus *Africanthropus* for the Eyassi skull is doubtful (this in any case is a *nomen nudum*). It seems more likely that it should be regarded as a distinct species of the genus *Pithecanthropus*, in much the same way that it is becoming widely recognised that *Sinanthropus* cannot be regarded as generically different from *Pithecanthropus*.

SECTION III

PREHISTORIC ARCHAEOLOGY

Chairman: Dr. L. S. B. Leakey

Vice-Chairmen: Prof. C. van Riet Lowe; Prof. Mustafa Amer Bey

Thursday, January 16th

THE LOWER PALAEOLITHIC IN THE ANGLO-EGYPTIAN SUDAN

A. J. Arkell

This paper has been expanded and published as 'The Old Stone Age in the Anglo-Egyptian Sudan' (Sudan Antiquities Service Occasional Paper No. 1).

SOME ASPECTS OF THE STONE AGE IN SOUTHERN RHODESIA

Neville Jones

When I first came to Southern Rhodesia, 35 years ago, the possibilities of research in prehistory were completely unsuspected and entirely unknown. A few stone implements had, however, by that time been collected in various localities and an exhibit in the Rhodesian museum at Bulawayo occupied one table case. Our classification was a simple one as we recognised only two cultures which we called Bushman and pre-Bushman. It was not long, however, before I became aware that the surface of the country was strewn with stone implements.

It was, I suppose, natural that the first task to be attempted (in 1917) should have been to dig a trench in the floor of a painted cave to see if it contained anything. It did; it contained a problem I could not solve. For the first time in Southern Rhodesia points trimmed on both sides by parallel flaking came to light, and when Leslie Armstrong came to Southern Rhodesia in 1929, I had no hesitation in sending him to Bambata Cave. He did some excellent work there and he provided us with a tentative sequence.

In 1937 a chance discovery was made at the Victoria falls by H. B. Maufe, then the Director of our Geological Survey. The railways at that time were straightening their line and had cut deeply into the Kalahari sand which at that point was about 30 feet thick and, at its base, a layer of carstone nodules resting on bedrock was revealed. Here Maufe picked up a few chalcedony flakes which were of umistakable human workmanship. The presence of artefacts beneath the Kalahari sand, which had hitherto been considered to be of Lower Pleistocene age, had until that

time been unsuspected. As a result of further investigation Maufe was able to satisfy himself that he had not been deceived and he added some hand axes and Levallois cores to his collection.

Shortly after this the Victoria Falls Power Company had occasion to dig a canal on the Northern Rhodesia side of the falls and in doing so laid bare a section of great importance and value. The researches of Cooke and Clark at this point and in the neighbourhood established Maufe's discovery and resulted in the building up of a sequence, both climatic and cultural, for the Zambesi valley. The scattered gravel patches on the fringe of the Zambesi Gorge below the falls had long been known as an inexhaustible source of stone implements and had proved a rich collecting ground to Fielden, Lamplugh, Codrington, Balfour and many others, no one of whom was able to ascribe this gravel to its proper position in any comparative sequence, though a very unsatisfactory attempt was made by Armstrong and myself in 1927.

When Cooke and Clark published their paper in 1939, the position of the gravel was established and the complete sequence for the Zambesi valley presented for the first time. We had thus a more or less complete account of the climatic and cultural developments of the area from at least the earliest phase of the great Handaxe culture until the present day. This work, which was the greatest contribution that had hitherto been made to the prehistoric archaeology of Rhodesia, has proved of the greatest assistance to those of us who have been trying to check up on these results by our own observations.

I do not propose to restate here the results of their observations and it will suffice to draw attention to one feature of the utmost importance which stood out—the comparative dating of a bed of ferricrete, which appears to equate with Maufe's carstone layer at the base of the Kalahari sand.

While Cooke and Clark were busy at the Falls, I was occupied in investigating a remarkable occurrence of stone implements in the Bembesi valley. A deviation of the Bulawayo-Victoria Falls road necessitated the making of an entirely new section along the banks of the Bembesi, a tributary of the Gwaai which joins the Zambesi some 40 miles below the Falls. For the purpose of obtaining road metal a number of pits were opened up along a 20 mile stretch of the road. I examined with some care eight of them, where I found exposures of the ferricrete layer at the base of the Kalahari sand and resting on bedrock. Above and below, as well as in the ferricrete itself, stone implements were abundant ; they

consisted of hand-axes, a great number of fresh or slightly rolled flakes (a few of which showed evidence of secondary trimming), large tools made from old cores, anvil and hammer stones and cores of both Clacton and Levallois technique, Clacton predominating.

The material was invariably the local sandstone, highly indurated, and the artefacts were for the most part rolled where they were lying exposed on the surface, but unrolled when found *in situ*. This association of hand-axes with the developing flake culture was something entirely new to me in Southern Rhodesia.

The Bembesi site thus provided abundant material for the study of the pre-Kalahari period which is very sparsely represented in the Falls area. It appeared to establish the fact, which I believe is borne out elsewhere, that in South Africa the flake industries cut into the hand-axe culture and that no vertical division can be established between them. It further showed that no fixed horizontal division can be established between the Earlier and the Middle Stone Age, the one merging into the other.

The oncoming of the arid Kalahari period must have made the continued human habitation of a large part of Southern Rhodesia impossible and it would appear that a large migration in a southerly direction took place. When we know more of the development of the Bembesi culture people in the Northern Transvaal we shall be able to fill a gap which so far Southern Rhodesia has been unable to supply. There is nothing so far as I know in our country between the Bembesi and the Proto-Stillbay, which latter culture indicates a considerable technical advance on the former.

A further point of interest in the Bembesi valley is the presence in the river bed itself of a bed of gravel in which typical rolled hand-axes of the Rhodesian Acheulean are associated with rolled Bembesi culture flakes, which gravel must I think be equated with the Younger Falls Gravel deposited during the Second Wet Phase.

The next task which I undertook, very unwillingly, was a revision of the work done by Armstrong at Bambata. I found it impossible to make the results he arrived at agree with my own reading of the development of the Rhodesian sequence and a trial hole which I made revealed the disturbing fact that the Proto-Stillbay burins and other tools occurred at the base of Armstrong's Acheulean. In 1939 I undertook an excavation immediately adjacent to that previously made by Armstrong and worked down to bedrock at a depth of 19 feet. I need not here describe it in detail as my record is easily available and it will suffice to note that

I could not confirm Armstrong's findings. There is no Earlier Stone Age deposit in the cave, the earliest culture represented being the Proto-Stillbay which is succeeded by the Stillbay and, lastly, the Wilton. The presence of some heavy tools very like hand-axes does not disturb me in the least, as similar tools occur in all our Middle Stone Age industries. Some of them may have been, and probably were, hand-axes picked up and made use of by Middle Stone Age man. There is no 'Mousterian' layer, the evidence for which could only be found in the Mousterian point which, however, is everywhere associated with the Middle Stone Age from its genesis in the Bembesi culture to the end of the Stillbay. I do not believe that Mousterian man ever reached as far south as South Africa. The physical anthropologists may have other views but, so far as his material is concerned, I fail to recognise him.

My next task was the revision of my own work at Sawmills. Since my first Sawmills paper was written in 1924, when we knew nothing about the cultural succession, I may I hope be forgiven for not having been able to produce results which, with my later experience, would satisfy me now. I had on this occasion the co-operation of my colleague Geoffrey Bond, and we went over the site together. We were able to establish a sequence and we found that the results we arrived at were in complete agreement with the data obtained elsewhere.

The special interest of the Sawmills site is of course its Magosian, which I had described sufficiently fully in my previous paper. I had not then been able to say more than that it had an Aurignacian flavour with a microlithic association, as the name Magosian was not then invented nor the culture known. Though I can, I think, justly claim to have discovered the Magosian, I am quite content to apply the name to what I then called the Sawmills industry. The name 'Sawmillsian' would be intolerable.

In my most recent paper I described the archaeology of a site at Lochard, the credit for the discovery of which lies with Geoffrey Bond. Not only did he discover pebble tools in a base gravel, but we were able to study an old land surface which yielded tools of the Earlier Stone Age in apparent association with those of the ferricrete layer and the Proto-Stillbay. We were able to sort them out and establish a sequence from the Older Stone Age to the Wilton, which generally agreed with what had previously been recorded.

We have thus been able to establish a cultural and tentative climatic sequence in Southern Rhodesia from the earliest days of

human occupation to the present day. We have succeeded in generally correlating our results with those arrived at in the Zambesi valley and we have made our work available by publication. There is still much to do ; we have not yet succeeded in recognising a developing technique in our Earlier Stone Age, probably for the reason that we have no Vaal river terraces. We hope, however, that a foundation has been well and truly laid.

I should like to mention the work being done on our rock paintings by Mrs. Goodall of the Queen Victoria Memorial Museum, Salisbury, who is doing invaluable work in copying and studying our paintings.

PREHISTORIC MOROCCO

A. Ruhlmann

Modern civilisation and its methods of investigation came late to Morocco, owing to the long political isolation of the country and in spite of its close proximity to Europe. Thus its archaeological exploration, like the rest of scientific research, dates really only from the establishment of the French Protectorate (1912). Gradually since that date prehistoric research has been carried out in the various regions, but documentary evidence varies considerably in each, and therefore it would be premature, even impossible, to try to present a true synthetic picture of prehistoric Morocco at the present time.

The nature of Quaternary man in Morocco has, however, been revealed by the discovery of fragments of a human skull at Rabat (1933). According to Dr. H. V. Vallois, some of the characters of the Rabat fossil resemble strongly those of Neanderthal man, while others still more primitive bring it near to Pekin Man (*Sinanthropus*). We are concerned therefore with a more archaic Neanderthal than in Europe, found in a well dated geological horizon.

Other fossil human remains were found (1939) in a cave at Cap Spartel, near Tangiers. They consist of the remnants of a child's skull (fragment of the upper jaw) and a molar (left M2) of an adult, which apparently belong to a true Neanderthal type. In addition to these Lower Palaeolithic remains, a skull belonging to the Upper Palaeolithic was discovered (1937) in a cave of the Atlantic littoral characteristic of fossil *Homo sapiens* (of a type

called 'Mechta-el-Arbi', the N. African form of the European Cro-Magnon).

That Morocco was inhabited by prehistoric man is borne out by the remains of his industries, which are distributed amongst the traditional cycles of the Lower and Upper Palaeolithic, the Mesolithic and the Neolithic.

Lower Palaeolithic

The oldest industry in N. Africa is the Clacto-Abbevillian, which was found (1941) in the Sidi-Abderrahman quarry near Casablanca. Proof is afforded that man appeared in Morocco in an epoch as early as in W. Europe, at the threshold of the Quaternary, by the stratigraphical position of this industry at the bottom of Pleistocene formations.

Consisting of combined Clactonian and Abbevillian (Chellean) techniques, the Clacto-Abbevillian comprises tools made of quartzite and feldspathic sandstone—'*triedres*', '*bifaces*' (some made on flakes, others of classic type) and also rough and retouched flakes.

In the same horizon but at a geologically more recent level, are massive hand-axes of amygdaloidal form with sinuous edges characteristic of the Abbevillian. Other Abbevillian industries have been found *in situ* in different quarries near Casablanca. Others again are known in the high valleys of the Mouloya and the Dra near Ouarzazate. Finally, many surface hand-axes have been reported from various places in east, central, Atlantic and south Morocco.

The type station of the Abbevillian is, however, the Martin quarry south-west of Casablanca. Interstratified between the pre-Quaternary substratum and various Quarternary continental deposits are two beds of marine quartzite conglomerate, remains of a former *cordon littoral*, which have yielded a rich Abbevillian industry. As well as almond-shaped implements, there are triangular, cordiform, ovoid and end-bevelled types. There are also a certain number of rough flakes and a few rare implements derived from them. Rolled and unrolled implements are present, indicating two industries of very different ages: the one is Abbevillian and the other Acheulean.

Apart from hand-axes, Acheulean implements include scrapers, cleavers and points, some made from cores and some from flakes. The Acheulean shows a real advance on the preceding Abbevillian in its technique which already shows secondary retouch, and in the typology of its implements.

Amongst the rare horizons *in situ*, typical Acheulean artefacts have been found at Beaulieu, Ain-es-Sebaa, Tit-Mellil (near Khemissat des Zemmours), Ain Fritissa (in the Mouloya valley) and Ouarzazate. Surface finds are fairly common in all parts of the country.

Parallel with these hand-axe industries are flake industries, represented in Morocco by the Tayacian, Levalloisian and Mousterian. The Sidi Abderrahman Quarry is the only place where the Tayacian has been found so far, and here it lies above the Clacto-Abbevillian. The implements are small, rather badly retouched and with ill-defined forms. They appear in two distinct superimposed beds, indicating that they belong to two successive phases, one early, the other developed. The tools are made on short, broad flakes and show the first appearance of facetted striking platforms. Their technique as well as morphology denotes the transition of this industry towards the Levelloisian and indirectly towards the Mousterian.

In Morocco these latter industries were never contemporaneous, but succeeded one another by direct evolution. On geological and stratigraphical grounds it seems that the Levalloisian and not the Tayacian is the origin of the N. African Mousterian.

The site which fundamentally enhances our knowledge of the Moroccan Levalloisian is immediately to the north of the Martin quarry. It is a mixed site (containing Moustero-Aterian artefacts as well as a Neolithic axe) but the main series of quartzite tools includes numerous oval Levalloisian flakes as well as points, scrapers, blades, etc., not less characteristic of this industry. Retouching is confined to a simple regularisation of the edges. Levalloisian industries are known from many surface sites and are apparently very widespread in Morocco.

The Levalloisian is followed by the Mousterian which is distinguished by the care taken in fashioning the tools, the variety of their forms and the perfection of their retouch. Two main types of tools are found: the point (triangular or oval) and the scraper, between which ranges a whole series of complimentary tools—blades, borers, notched tools, rare burins, etc. These implements are generally worked on one side only (the dorsal surface of the flakes has been thinned and regularised). Although known from many surface sites, the Moroccan Mousterian has only been found at a few rare horizons *in situ*. Amongst the latter sites are the cave of Kifan-bel-Ghomari (at Taza) and the so-called Pigeon Cave at Taforalt. In these two caves the Mousterian lies under an Ibero-Maurusian horizon.

The Mousterian in Morocco—and probably throughout Africa—ends the Lower Palaeolithic and is contemporaneous with the last N. African Pluvial and the last European glaciation.

Upper Palaeolithic

The Mousterian developed during the last Pluvial and leads on to the Aterian. This industry is found sporadically in Egypt, abundantly in N. Africa and also exists in the Sahara, French W. Africa (Mauritania) and French Sudan (Gao).

The Aterian differs from the Mousterian only in the appearance of new tools—particularly scrapers and points. In the course of its development the Aterian gains other forms, notably leaf-shaped points or ' laurel leaves ' as well as rarer tanged points, one kind tapering and winged, another lozenge-shaped. These points are worked on both sides, whereas most of the rest of the tools are worked only on the dorsal side.

As elsewhere in N. Africa, the Aterian seems to have penetrated Morocco to an almost unlimited extent. Amongst the many surface sites are two at about 2,000 m. altitude, whose interest lies in their position high up in the mountains.

Aterian horizons *in situ* include two caves at El-Khenzira (south-west of Mazagani), the first of which contains one Aterian level and the second two. From this succession (later found in another cave dwelling at Dar-es Soltan) it appears that there was a lower and an upper Aterian horizon. The Aterian dates from the post-Pluvial period of the Upper Palaeolithic and constitutes the only known prehistoric remains belonging to this period.

Mesolithic

The Aterian *in situ* is often overlain by a microlithic industry: the Ibero-Maurusian, consisting of narrow blades with finely retouched backs. The assemblage also includes scrapers, triangular points, borers, notched tools, etc., and also tools with geometrical shapes (crescents, triangles, trapezoids) as well as the micro-burin. This industry contains implements worked in bone (awls, needles without eyes and points) but has no polished stone or pottery. Numerous fragments of ostrich eggshell are found, the remains of vessels.

The Ibero-Maurusian exists both in the open and in caves and extends over a wide area along the coast from the Algero-Moroccan frontier to beyond Cap Blanc in Morocco. It has also been found here and there in the Atlas mountain region

Like the Aterian, the Ibero-Maurusian does not represent a self-contained unit, but is a branch of the Upper Capsian which is found in S. Tunisia and S. Constantine but never penetrated Morocco. The Ibero-Maurusian is a Mesolithic industry filling the gap between the Upper Paleolithic and the Neolithic.

Neolithic

The Neolithic appears at the beginning of the Recent geological period, when the climate, fauna and flora were similar to those of to-day. Man definitely entered a new age at this time and his life was changed radically as he started to keep domestic animals and abandoned hunting for agriculture and herding.

Stone tools are still abundant and the development lay less in the type than in the retouch. The first polished stone tools appear, especially the axe, but also adzes, chisels, pestles, wedges, pick-axes, etc. Work in bone continued and needles with eyes made their appearance. A new object is the quern. Finally of course the Neolithic would be inconceivable without pottery.

In Morocco two principal zones of Neolithic penetration can be distinguished: one coastal (near Tangiers and particularly in the region between Casablanca and Mazagan) and the other central, in the vast plains extending from Meknes to El-Hajeb, but the Neolithic is also found in the east and the extreme south of the country.

An early and a late phase can be distinguished, though it is not always easy to separate the two and Neolithic horizons are rarely seen in relation to older or more recent archaeological beds.

Only one early Neolithic level has been found *in situ*, at the Dar-es-Soltan cave south-west of Rabat, where it overlies earlier industries. It forms a transitional stage between the Ibero-Maurusian from which it is derived and the true Neolithic. In this early Neolithic industry the blade and microlithic characters typical of the Ibero-Maurusian are preserved, while the first polished stone implements as well as pottery and new kinds of tools appear. This new civilisation does not arise from a pure and simple evolution on the spot, but absorbs influences from the south-east and the north.

The best known Neolithic habitation in Morocco is at the Achakar cave at Cap Spartel, where a double burial and a varied and complete assemblage of tools was found. Besides rather poorly made flint implements, there are polished axes, small bone tools, ornaments (pierced shells etc.), and four complete vases together with numerous fragments of pottery.

Some of the pottery resembles certain examples from Spain (in technique as well as decoration) so closely that it must indicate that infiltrations of population crossed the straits bringing with them elements of a very advanced civilisation. Unfortunately the study of the Neolithic is more complicated than is the case with the Palaeolithic owing to the lack of stratigraphical data, and the limits of the zone penetrated by these influences from the Iberian peninsular cannot be defined.

Similar influences are to be seen in the industries of the coastal region—in the typology of the stone implements (punched and partially polished axes, etc.), in the shape (simple technique, conical base) and in the decoration of the pottery (incised or punched motifs). Sites in the central region, however, show different parentage to that of the Oranian Neolithic of the east.

Connections between the extreme south, central and Atlantic Morocco must have existed since Neolithic times however. Saharan elements in the Neolithic sites north of the Atlas must be accounted for in this way—particularly the arrowheads but also certain pottery decorated by comb and wheel.

Despite signs of exterior influences, however, the Moroccan Neolithic has kept its individuality. Weapons such as arrows are rare, while stone implements which vary according to the locality are abundant: for instance on the site of a village they are concerned with farming (pickaxes, hoes, etc.) while others found at the sides and foot of a mountain ('The Salt Mine'—Maden el-Mlah) consist of miners' implements used for extracting rock salt (picks, mallets and sledge hammers).

Neolithic man thus belonged to an agricultural society, in which there were herds and artisans (makers of tools, miners, etc.) and was apparently not war-like, although he must have been constantly on guard against wild animals and his neighbours. The ruins of fortified refuges built by these people evidently served as temporary protections for their women and children, beasts and crops, in the case of enemy attack. The construction of these fortifications and also the fact that their defence needed co-operative effort shows that they had a social organisation.

These men were representatives of the 'Mechta-el-Arbi' race, and in them can be traced the ancestors of the present day Berber population.

Rock Paintings

Amongst the forms of art found on rocks are the true rock paintings and the Libyco-Berber engravings. The first of these

alone, which is of Saharan character, merits the name of Prehistoric. The rock paintings depict an ancient fauna which includes elephants, hippopotamus, rhinoceroses, large felines, many kinds of antelope, ostriches, etc. and also the first animals to be domesticated : ox, horse, dog, goat, sheep, etc.

Although the Moroccan petroglyphs are an integral part of this type of art in N. Africa as a whole, they differ from those elsewhere in more than one respect. Human figures are rare, and no hunting scenes or scenes depicting animal life are found. The figures are also smaller, certain life-sized drawings being the exception. Apart from the paintings at Figuig, which are the most important and the most representative, the Moroccan rock paintings do not show much artistic merit. Their relative age is not known, but it seems that the majority of the paintings are the work of Neolithic Saharans.

The Libyco-Berber engravings never represent Quaternary fauna, but depict the camel, and they are attributed to the fourth century A.D. The oldest engravings of this series belong to the ' long dark centuries of the Maghreb '.

Prehistoric Morocco ended with the Neolithic and its industries passed gradually from stone to iron, without going through the Bronze Age, and from then the country enters gradually into the Historic period.

RECENT PREHISTORIC RESEARCH IN THE SOMALILANDS

A SUMMARY OF THE CULTURAL AND CLIMATIC SUCCESSION

J. Desmond Clark

Somaliland has long been known to be rich in Stone Age material and collections have found their way into a number of European and African museums. However, with the exception of excavations by Teilhard de Chardin and by the Abbé Breuil and P. Weinert in the cave of Porc Epic at Dire Dawa in 1930 and by P. Graziosi at Bur Eibe and in the Nogal in 1935, all data previously collected and described consists of surface finds, the exact provenance of which is not always clearly indicated. Previously workers here have had to rely, therefore, on typological evidence and physical conditions for estimates of the age and cultural associations of the specimens they found. The writer's own work spread over some two and a half years was, therefore,

directed towards providing the necessary stratigraphical evidence on which to base the cultural and chronological sequence for the Stone Age Cultures in the Horn of Africa.

THE GEOLOGICAL AND CHRONOLOGICAL SUCCESSION

Western British Somaliland

The gently undulating surface of the plateau south of Hargeisa is covered by boulder beds, for the most part conglomerates and residual pebble beds set in a calcareous matrix, which cover a large part of this northern plateau country and were apparently deposited during a long wet cycle. These boulder beds antedate the present drainage system and may be of Pliocene age.

A period of valley cutting then followed, in which boulder beds and breccias of a similar nature to the beds on the plateau, covered and cemented by a thick layer of tufa, were laid down. They have yielded no archaeological material. They lie at heights of between 175–200 feet above the bed of the '*tug*'.

A long period of denudation followed, equated with the first half of the Gamblian Pluvial, and the valley was deepened to below the level of the present *thalweg*. During the declining stages of this wet phase two deposits of coarse Older *Tug* Gravels were laid down, each overlain by a brown to red sandy alluvium which extends right across the valley floor. The two alluvia are sterile, but the gravels and sandy grits contain many artefacts, for the most part unrolled, of the Acheulio-Levalloisian Culture. The absence of sorting and bedding of the gravels indicates typical torrent action and deposition under semi-arid conditions over a longish period.

Overlying the upper alluvium of the Older *Tug* Gravels on the valley sides is a detrital bed, represented by rubble and derived components of the gravels, indicative of a former land surface. It is dated by the Upper Levalloisian industry found within it to the end of the Upper Gamblian; on its surface and in the overlying red sand occur sealed factory and living sites of the Somaliland Stillbay.

During the second half of the Gamblian, the Older Gravels were largely eroded from the centre of the valley and the bed of the *tug* was again cut down to below its present level. This denudation was followed by the deposition of a coarse gritty gravel overlain by a thick deposit of red to brown sandy alluvium. Implements of Developed Levallois type occur, for the most part

unrolled, while near the surface occur a few flakes and implements of the Somaliland Stillbay culture.

Following upon the two series of deposits laid down during the Gamblian Pluvial and its terminal arid period, there is evidence of a further semi-arid or wet phase of lesser intensity. Within eroded channels was laid down a thin gritty gravel overlain by a sandy grey alluvium with occasional grey to black clay bands. The neanthropic Hargeisa Culture is in part contemporary with this period. The Somaliland Wilton, which is directly derived from the Hargeisan, may be dated to the decline of this phase and to the beginning of the present cycle during which the *tug* and steep tributary gullies were eroded to existing contours. The sequence in the *tugs* at Borama and Mandera is very similar to that of Hargeisa.

The Nogal Valley

The Nogal sequence may be divided into two contemporary series of events, that which is evidenced in the Upper Nogal and that found in the gorge of the lower course of this *tug*.

Towards the centre of the valley, between Garoe and Callis, are flat topped ridges and low plateaux covered by coarse gravels and boulders deposited apparently under fluviatile conditions. They lie about 200 to 250 feet above the central plain ; no archaeological material was found to be associated other than Late Stone Age surface scatterings. They are tentatively referred to the Great or Kamasian Pluvial.

Subsequent to the aggradation of these valley boulder beds, there occurred a period of fairly intense erosion and the existing subsidiary *tug* system came into being. This pluvial phase resulted in the deposition of two coarse gravels separated by deposits of gypsum stained by iron oxides to a pinkish red. They have yielded good representative series of the Lower and Upper Levalloisian cultures respectively. The formation and oxidation of the gypsum suggests that these aggradations were each succeeded by a period of increased aridity.

Denudation followed and the *tug* was filled by loosely packed torrent gravels and a fine grey-brown alluvium. Occasional abraded Somaliland Stillbay implements occur within these gravels. The climatic cycle of gradually increasing aridity is completed by the erosion of the *tug* to its present base level and the deposition of a fine windblown sand over the surface of the plain.

The initial erosion of the short but nearly 400 foot deep gorge of the lower Nogal probably dates to the end-Tertiary or beginning

of the Pleistocene on the evidence of the deposits found to occur within it.

Within the gorge at Eil, a bench level has been cut into the soft limestones and sandstones and stands approximately 75–100 feet and more in the upper reaches, above the level of the *tug*. At Got Ad, a few miles upstream from Eil, a thick cemented deposit of false bedded feruginous sands and gravels capped by a thick travertine bed fills the gorge to the level of the bench. These beds, which appear to be of fluvio-marine origin, are unfortunately sterile of artefacts. Lying on the bench, however, at the foot of a low hill of ferruginous sandstone, is a factory site of the Acheulio-Levalloisian culture with representative, but heavily weathered, examples of tools of this culture, which were eroding from a deposit of ' steppe lime '.

A further period of denudation resulted in the deepening of the gorge to below its existing base level, and the subsequent aggradation of two torrent bedded gravels, each succeeded by deposits of grey sandy silts, capped by tufas. Within these gravels occur Upper or Developed Levalloisian tools, while in and below the upper tufa there is a good series of Stillbay artefacts. During this time, springs on the left bank of the *tug* were active, and within the tufas marking the extent of these fossil springs, Stillbay and occasional Levalloisian material occurs. There followed an erosion phase of lesser intensity, when coarse angular gravels and boulders were deposited on the denuded surface of the *Tug* gravels. Nothing of note has been found in these gravels, but surface collections of Somaliland Wilton, which also occurs stratified in rock shelter sites at the mouth of the Nogal estuary and Doian implements (described below), post-date this period. In rock shelters the strandlooping Wilton occurs underneath a sterile windblown sand. The sequence is completed by the present arid phase.

The Webi Shebeli

In Southern Somalia and in the centre, the sequence is closely similar and is most complete and best seen in the middle course of the Webi Shebeli and its tributary *tugs*. On the plateau surface have been deposited tufaceous breccias and pebble beds, attaining depths of 20 feet or more : they are sterile of artefacts and are considered to be the counterpart of the Plateau Boulder Beds in the north.

A long erosion cycle followed, which resulted in excavation of the existing valley system. This period can be divided into two sub-phases, the earlier being clearly seen in profile in certain

hanging valleys, between Melka Taka and Belet Wein. The decline of this pluvial period (the first half of the Great or Kamasian Pluvial), is marked by the accumulation of breccias, limestones, or very hard calcretes and gypsum, on the upper slopes of the valley.

The next phase is one of erosion resulting in the downcutting of the valley to the new base level and the formation of ferruginous gravel terraces at heights of from 30 to 50 feet above the Bur Eighei barrier to 100 feet and more at Bugda Acable, and approximately 200 feet in the Bur country. These gravel terraces rarely attain more than a few feet in thickness. Their formation certainly antedates the presence of the Levalloisian culture, as implements are found unrolled resting on these gravels; in some instances the tools have been rolled by secondary gully action. These are assigned to the second or last part of the Great or Kamasian Pluvial.

A further period of denudation and aggradation followed and resulted in the deposition within the Shebeli and its tributaries of two gravels. The lower of these beds has yielded a good series of Lower Levalloisian artefacts unrolled. The upper gravel, calcrete and alluvium, contains good unrolled examples of the Upper Levalloisian. The upper part of the grey alluvium has been oxidised, as is also the case with the upper tufas on the valley sides and represents a fossil land horizon. Contemporary with this land surface, or slightly later in the Fafan, at Jesomma, and in the Bur country, is the Somaliland Stillbay, which is followed closely by the Somaliland Magosian. Contemporaneous also with the formation of these valley tufas was the formation of similar deposits in the shallow pans or well areas on the plateau. There are two phases of tufas found here also, the former of rock hardness, which has yielded at El Dubbo and Bugda Cosa implements of Lower Levalloisian type, associated with a fossil fauna in the former instance.

A minor period of erosion in the Shebeli valley resulted in the deposition of gravel pockets and the extensive flooding of the lower parts of the valley with grey-brown alluvium, often intercalated with bands of lighter coloured grits. Overlying this alluvium are compact aeolian sands, red to buff in colour and sterile of artefacts. The Somaliland Magosian is in part contemporary with this wet phase. Finally, contemporary with the present period of river cutting is the Doian culture which is found resting on the red aeolian sands and often covered by unconsolidated orange to yellow dune sands.

Southern Danakil Rift

Mention must be made of the deposits to be found in the Danakil Rift between Dire Dawa and the French Somali border. The Dire Dawa end of the Aussa Plain is built up of stony delta sediment while in the Asha Adele area, this is replaced by fine grained and evenly bedded clays, sands and grits, with false bedded gravel lenses reaching a depth of more than 50 feet in places, notably south-west of Asha. A good section of these detrital gravels and alluvial fan deposits is exposed in the Garasleh *Tug*, where the road from Asha crosses, about 30 miles north of Dire Dawa. Here are to be found on the right bank two main aggradations of gravels consisting of well rounded pebbles showing fairly pronounced banding but little sorting, separated by from four to five feet of red alluvial clay ; a similar alluvium in turn overlies the upper gravel. Above this upper alluvium is a thickish pebble bed having the appearance of a former land surface. This in turn is overlain by about four feet of red lavas of the Aden series volcanics. The upper gravel bed has yielded one large flake showing prepared platform technique, one roughly prepared core, and two flakes with unprepared platforms, all unrolled. They should possibly be assigned to the Acheulio-Levalloisian culture.

A long period of denudation followed and resulted in the erosion of these lavas and much of the underlying gravel and was followed by the deposition of a coarse eluvial gravel in which occur rolled and weathered Lower Levalloisian tools. In addition to these there are also found unrolled and fresh Upper or Developed Levallois implements for the most part overlying the gravel. A minor wet phase of decreased intensity followed and banded torrent gravels set in a calcareous matrix were deposited and covered by a brown sandy alluvium. With the exception of three flakes with facetted platforms and one prepared core, this deposit is sterile. On the surface of this and earlier deposits are found scattered sites of the Somaliland Wilton.

Coastal Deposits

North Coast. On the Gulf of Aden coast can be distinguished two clearly marked levels, a 200 metre level lying at the foot of the barrier hills on the coastal plain, which was first recognised by Macfadyen at Dubar, and a $\pm$ 8 metre raised beach at Berbera, which is recorded also at a number of points all along the northern and eastern coasts as well as in the Red Sea.

The 200 metre level is marked by conglomerates set in a hard

calcareous matrix and passing into marine sands near the coast. It is probably of Lower Pleistocene age or earlier. No archaeological material has so far been collected from within it. Resting on these conglomerates, however, there occur usually in a considerably weathered condition, Acheulio-Levalloisian and numerous Levalloisian implements.

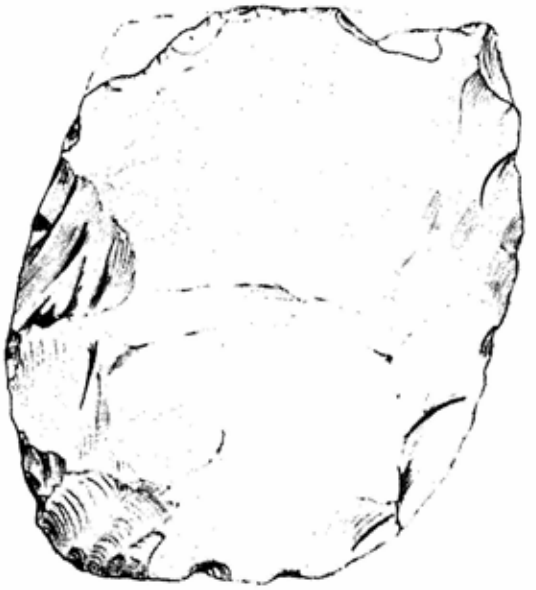
From approximately the 200 m. to the 10 m. contour are found beds of coarse conglomerates, sandy clays, gravels and sands which suggest a fresh and not a salt water origin. They are in fact alluvial fan deposits laid down by streams and rivers discharging northwards on to the coastal plain; no implements have been found within them.

The ± 8 metre raised beach, which varies in consistency from a consolidated coral limestone to a well cemented pebble bed set in a sandy matrix, has unfortunately yielded no artefacts. Teilhard de Chardin, however, suggests that in the area between Mount Mabla and Obok in French Somaliland this beach which, due to earth movement, is found at 25 metres, grades into the 30 metre terrace on the slopes of Mount Mabla and is contemporaneous with the Levalloisian culture. At Berbera very occasional weathered epi-Levalloisian and Somaliland Stillbay flakes overlie this beach. Marine regression to at least —78 m. below sea level followed; this is seen in deep bore holes at Zeila. Contemporary with the transgression of the sea to a level ± 2 m. above sea level and the present beach level, is the accumulation of yellow, compacting dune sands.

East Coast. On the east coast certain conglomerate beds at Warandi and elsewhere in the Mudugh, inland from Obbia, occur at approximately 170—200 m. a.s.l., and beach or terrace remnants round the foot of some of the '*Burs*' in the southern coastal plain in the vicinity of Bur Hakaba (approximately 200 m.) are probably the counterpart of the 200 m. conglomerates of the Gulf of Aden coast; they rest on the coastal peneplane.

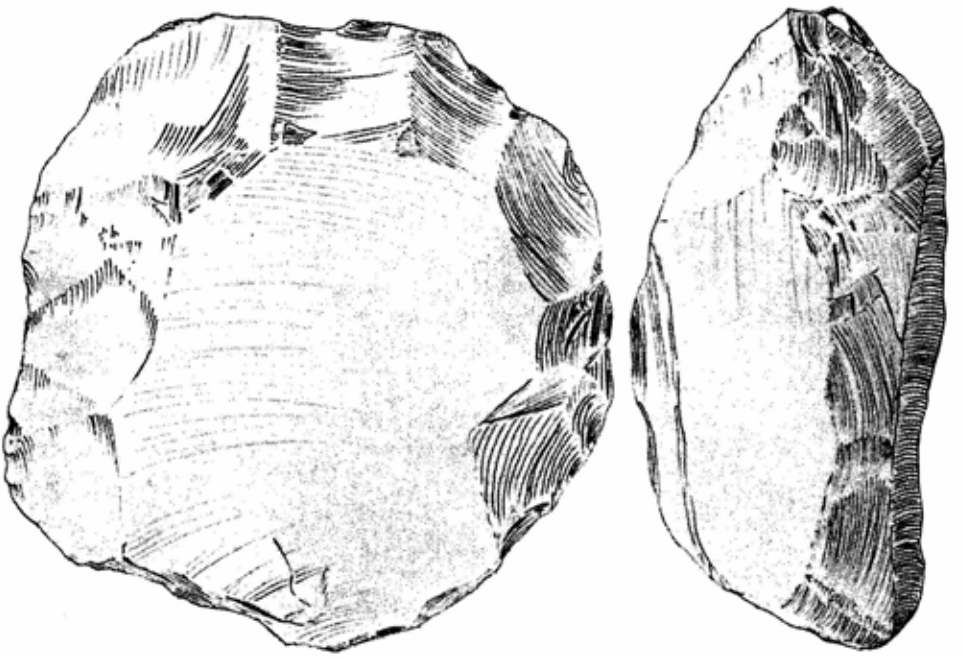
The pebbly calcretes and alluvium of the Wanle wein-Bur Hakaba-Matagoi Plain (100–200 m.) and the later gypsiferous and calcareous sands of the Obbia coastal plain may in part be contemporary with the alluvial fan deposits of the north coast.

Subsequent to the formation of these beds there followed a period of marine retrogression which is evidenced by the erosion of the marine current bedded sands and corals on which the later coastal deposits rest. Overlying these sands there is a well developed beach at 0–2 m. above the present sea level with numerous marine and some land molluscs. Although no implements have yet been



(*a*)

(*b*)



(*c*)

FIG. 1. Lower Acheulio-Levalloisian, from Hargeisa, N.W. Somaliland. (*a*) U-shaped cleaver of quartzite, slightly rolled. *In situ* in Older Gravels 1, Site H.12 ; (*b*) sub-triangular hand-axe of quartzite, slightly rolled ; *In situ* in Basal Gravels, Site H.8. (*c*) large circular prepared core of quartzite, slightly rolled. *In situ* in Basal Gravels, Site H.8. [*To face p.* 152

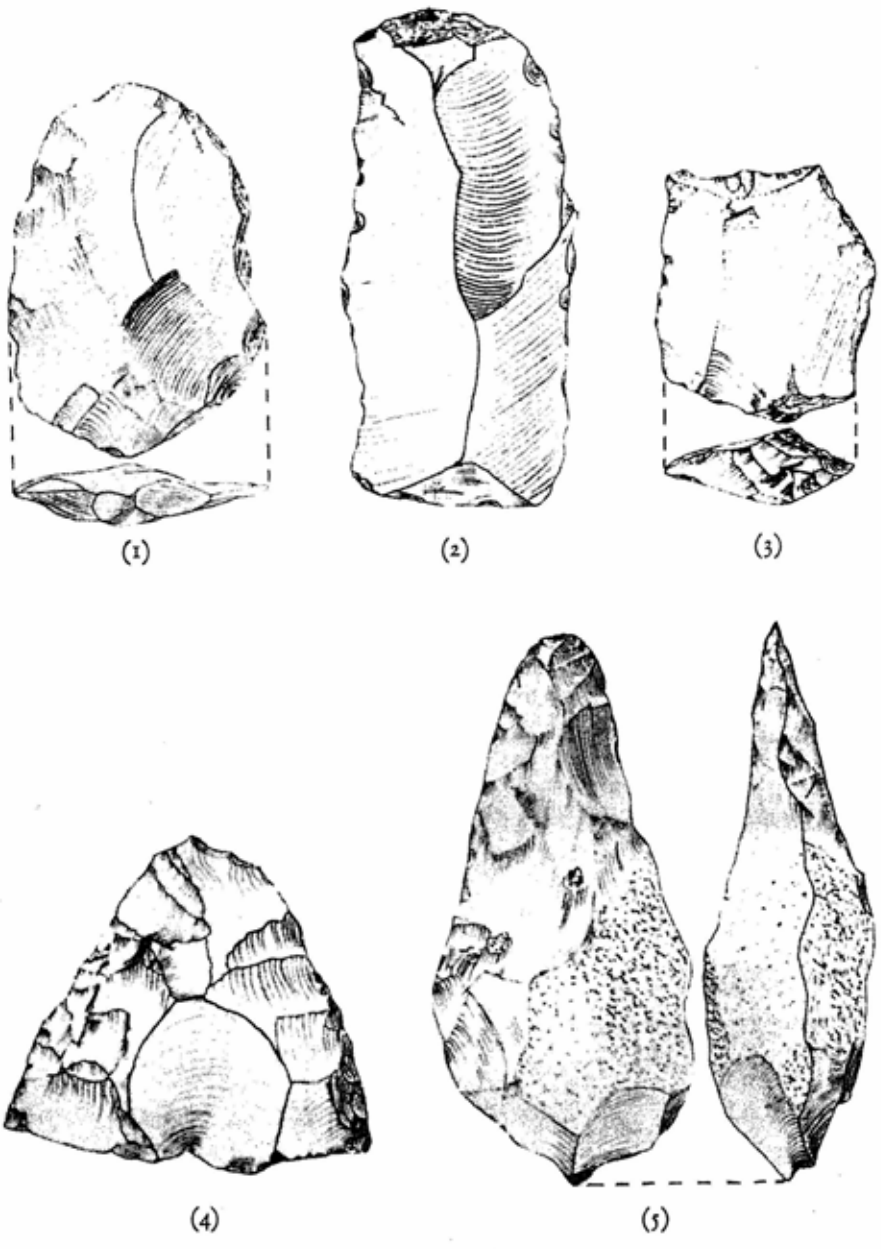


FIG. 2. Upper Acheulio-Levalloisian, from Hargeisa. (1) Broad faceted flake showing radial flaking on upper surface, of quartzite, unrolled; (2) flake-blade with inclined unfaceted platform; (3) end-scraper on faceted flake with parallel flaking on upper surface, of quartzite, unrolled; (4) half of a broken hand-axe re-utilised as a core, of chert, unrolled; (5) pointed hand-axe, of quartzite, unrolled. *In situ* in Older Gravels 2, Site H.12.

found within the beach, it is thought to be contemporary with the Lower Levalloisian culture.

At the majority of sites this beach is overlain by thick deposits of consolidated fossil dune sands showing typical aeolian bedding. It was at this time that the main barrier of coastal dunes was formed down the length of the southern half of the east coast. The dune formations appear to be contemporary with a period of increasing or decreasing rainfall and were accumulated in large measure by very strong monsoon winds blowing probably from the south-west.

Overlying in some sections, or more commonly banked against these dunes, is a well-developed beach situated at from 5–15 m. above present sea-level, but careful search has so far yielded no archaeological material within it. However at Eil, in the detrital material resting on the beach, were found rare Somaliland Stillbay implements, flakes and a core. The beach itself, identified with the ± 8 m. beach of the north coast, would thus seem to be in part contemporary with the Upper Levalloisian.

This beach is usually found to be overlain by a further deposit of less consolidated dune sands which form a second and lesser barrier running parallel to the earlier dunes which lie further inland. Later again, compact dune sands, usually bright red in colour, turning to yellow at the coast itself, were accumulated and indicate arid conditions and the close of ' pluvial ' times. During this period the sea reached its present level and yet other sand dunes accumulated, this time orange in colour and unconsolidated. Beneath these sands and resting on the eroded surface of the red sand are found living sites of the Doian and Somaliland Wilton peoples : this latter sequence is well seen in a rock shelter at Beide at the mouth of the Nogal.

The sequence of events, in both inland and coastal areas, is summarised in the attached Table.

Description of Cultures

The Acheulio-Levalloisian (Lower Acheul-Levallois Fig. 1 ; Upper Acheul-Levallois Fig. 2).

The earliest recognised culture in the Somalilands has been termed the Acheulio-Levalloisian. It is just possible that some of the material collected by Seton Kerr from the *Tug* Issutugan may antedate this culture and represent an Upper Acheulian.

The Acheulio-Levalloisian culture is found only within the Older *Tug* Gravels of the north-western Somali rivers, and its dating is therefore dependent on the date of these gravels. From

the position in which they occur, filling the lower parts of the buried channel in the Marodigeh *Tug*, it would seem that they should be assigned to the beginning of the Last, or Gamblian, Pluvial and not to the end of the preceding Kamasian Pluvial. An end-Kamasian date must, however, be considered as a possibility, and some degree of corroberation for this is given by the sections in the gorge of the Lower Nogal at Eil.

The Younger *Tug* Gravels cut through the Estuarine Beds and yield typical Levalloisian assemblages as in the north-western rivers. Should therefore the Older *Tug* Gravels prove to be contemporary with the Estuarine Beds, which clearly belong to a cycle anterior to that which produced the Younger Gravels, then the main development of the Acheulio-Levalloisian must be assigned to the end of the Kamasian Pluvial, a position which incidentally makes for closer correlation with East Africa.

The centre of diffusion of the Acheulio-Levalloisian in Somaliland appears to have been the north-western part of the plateau, as it is here that it reaches its highest development, and the greater number of sites are located. It was diffused into the Guhan in the north, to Daghabur in the south, and to Sheik and the Nogal in the east. The type sites occur at Hargeisa.

In spite of careful search, this culture appears to be entirely absent from the greater part of Somalia. Analogous cultures are to be found in the Acheulio-Levalloisian of Kharga Oasis, in the Abyssinian Fauresmith from Gondar, in the material from Mega at the southern end of the Abyssinian Plateau, and in the Kenya Fauresmith of Nanyuki.

Tool types include well made pointed handaxes of Micoque form. Usually the butt is left untrimmed but specimens are also found with the butt carefully worked and rounded. Tools vary in length from 9 to 3 inches on an average. The dominant technique is Acheulian, but resolved flaking also occurs not infrequently. In addition to the pointed varieties of *coup-de-poing* there are found cordiform, limande and ovate examples. The hand-axe element comprises approximately 30 per cent of cultural equipment, but there occur also well made U-shaped cleavers, formed, as are also many of the *coups-de-poing*, on large end-flakes often struck from crudely prepared cores. These cleavers never show the Vaal River parallelogram technique but are trapezoid in section, the side edges of the tool having been carefully trimmed from the main flake surface; the butt is usually carefully rounded by removal of the bulb and platform.

In addition to the core tool element there is a large number of

flake tools, many showing careful facetting of the butt, indicating that they have been struck from prepared cores. The most characteristic core resembles the 'horsehoof' core of the Vaal River, that is to say it is a large, round, conical backed core showing on its upper surface, if it has been struck, the remains of radially directed trimming flakes and the negative scar of a large broad prepared flake. The flakes show radial flaking on the upper surface, and usually a straight faceted butt set almost at right angles to the main flake surface; the edges of these tools rarely show much secondary trimming except that which is the result of use. The disc core is also present and yields Mousterian-type flakes: secondary trimming is more in evidence on the flakes derived from these cores. In addition, must be included an occasional rare stone ball or bolas, long flake-blades struck from unprepared cores, together with a number of shorter flakes with inclined unfaceted platforms struck from single platformed unprepared cores. At the factory sites the typical flakes, waste products of the Acheul 'wood-technique', occur.

The industry contained in the upper gravels and grits shows surprisingly little development from that in the underlying bed. A general sophistication of *coups-de-poing* and especially cleavers is noticeable in the upper beds however, while there is also a higher percentage of prepared cores.

This culture is essentially the result of adoption of the prepared core technique by a developed form of the African Chelles-Acheul Culture.

The Lower Levalloisian. This culture is more widely diffused occuring at sites throughout the Somalilands, and may be assigned to the second peak of the Last, or Gamblian, Pluvial and is thus later in date than the Acheulio-Levalloisian, from which it is almost certainly derived. The most satisfactory evidence for dating it comes from the Shebeli terraces and from Eil in Somalia, from the Dubar 200 m. beach in British Somaliland, and from Mount Mabla in French Somaliland. The culture is often exceedingly crude and the Levallosian technique is not finely developed. Tool types comprise large crudely prepared cores from which flakes showing primitive facetting of the butt and rough radial flaking of the upper surface have been struck. Often the butt may be found to be unfacetted but the upper surface of the tool determines the technique that has been used. Crude chopping tools sometimes occur. Smaller prepared cores are typical as well as the flakes that have been struck from them. In the Shebeli, where pebbles were available, there are found small pebble choppers which if found

out of their context would suggest a far greater antiquity. Occasional large end-flakes with wide-angled unprepared butts occur, particularly at the Dubar site. The primary technique employed is essentially a stone technique; secondary work where present shows steep resolved retouch and notching and nibbling of the edges of the tool, and appears rather to be the result of utilisation than of deliberate retouch.

The Upper Levalloisian. This culture is universal throughou-the Somalilands. The type site is the *Tug* at Garoe, but good colleci tions have also been made from the *Tug* Fafan, Hargeisa, Warandt near Obbia, the Garasleh *Tug*, El Dubbo, God'dere, Jesomma, and other sites.

Typical artifacts are the disc core, often quite small, showing either flat or conical section, and the Levallois flake. Variations of the disc core are the sub-rectangular core and the sub-triangular, or so called tortoise-point form. The larger form of radially flaked Levallois core also occurs but is never as common as the disc core. Prepared flakes are of two kinds—thin broad radially flaked examples and pointed flakes with convergent flake scars and thickish butts. Platforms are always carefully facetted and symmetrical. End flakes also occur both with facetted and unfacetted butts. Secondary work is of a resolved nature and notches and 'nibbled' edges are common. Crude bifaced or parti-bifaced foliate points made their appearance at the end of the Levallois-sequence.

The Somaliland Stillbay. The Stillbay is perhaps the most widely distributed of all the Somaliland Stone Age Cultures. The type site for the north is at Hargeisa, which has yielded some very fine specimens, and for the south is at Bur Eibe. Equally representative material has been recovered *in situ* from the *Tug* Fafan, Eil, Mandera, Jesomma, and by others from Sheik and Dubato, and from the Bourg de Bozas sites of the Upper Webi Shebeli and Dacata valleys.

The Stillbay can be subdivided into an Upper and a Lower Somaliland Stillbay. In the Lower Stillbay unifaced points predominate and are usually sub-triangular in shape, the butts being left untrimmed. Bifaced points occur however in fair numbers both of foliate and sub-triangular form, but the butts are usually not trimmed away, and the implements are poorly made, though a few bifaced points as good as anything produced subsequently are occasionally found. Other tool types include scrapers of various kinds, the usual form showing a scraping edge down the length of one edge and round the end of an end-flake. Side scrapers are very rare. The Tabelbalat technique is found.

The Upper Somaliland Stillbay represents the finest development of this widespread culture and a number of forms of point are found. The striking platforms and bulbs are usually removed and the butt carefully rounded and trimmed. The secondary technique is predominantly pressure, or possibly a controlled form of 'wood-technique', but resolved retouch is present particularly on the scraper forms. Primary flaking is essentially Levalloisian and 'type fossils' are the disc and subtriangular prepared cores and the faceted Levallois flake. In fact if the end products from the Stillbay factory site are removed, the assemblage might well be referred to the Levalloisian. Beautifully finished unifaced and bifaced points are the type 'fossils', variations on the laurel leaf and sub-triangular forms predominating, but cordiform, and willow leaf points occur.

There is greater variation in scrapers and the true end-scraper now makes its appearance. Rather poorly made backed blades and microliths must also be included, as well as occasional large bifaced chopping tools.

The Hargeisan Culture. Stratigraphically overlying the Lower, but contemporary in part with the Upper division of the Somaliland Stillbay at sites at Hargeisa, Borama and Mandera occur industries, the tools of which often exhibit a glossy patina due apparently to polishing by wind action. The characteristic elements distinguishing these industries have not yet been identified for certain outside the bounds of British Somaliland and the Mijertein, but it is probable that they will be found to occur in the western Ogaden and the Galla provinces of the high plateau; their known distribution is however confined for the present to the northern part of the Somali Plateau.

These industries exhibit clear neanthropic, or blade and burin, affinities but include also certain elements that have presumably been adopted from the Stillbay complex. These elements—occasional disc cores and rare Magosian-like points distinguish the culture from the other blade and burin cultures of Africa—from the Kenya Capsian and the true Tunisian Capsian. While it is recognised that these industries represent clearly a local variant of the neanthropic complex, it has nevertheless been thought necessary on account of their specialisation to raise them to cultural status under the name Hargeisan after the site where characteristic flaking floors were first found *in situ.*

The material culture consists of typical blade cores, single and double ended; large, straight, blunted backed-blades which however are rather rare; numbers of microliths, for the most part diminutive forms of the larger blades, showing usually

straight blunted back or even concave backing, the working directed from one and occasionally both faces of the tool. Typical is the basal retouch at the bulbar end of these microliths where the backing has been carried for a short distance on to the cutting edge of the tool. Good angle-*bec-de-flute*, and polyhedral burins are present. Scrapers are characteristic and of two kinds : a large disc scraper, made on a broad unprepared end-flake, and the other a normal end of blade scraper—both single and double forms occurring. Also found, however, are rare diminutive rather crudely made sub-triangular unifaced points with resolved flaking; occasional finely made specimens are also known. Very rare hollow-based arrowheads make their appearance in a derivative industry of the Hargeisan at one site at Hargeisa.

The Somaliland Magosian. The contemporary of the Hargeisan in the central and southern parts of the plateau is a culture that has been given the name Somaliland Magosian. It is the local Somaliland equivalent of generally similar cultures in East Africa and the sub-continent which appear to represent typologically a fusion between the earlier, Middle Stone Age, complex and the later microlithic blade industries.

The type site of the Somaliland Magosian is the Gure Warbei, a rock shelter at Bur Eibe, but it is also widely represented in the Webi Shebeli, in the lower Nogal, and in a number of well areas in the Haud as well as on the plateau and coastal plain between the Webi and the Juba.

At Bur Eibe the Magosian is stratified above the Stillbay and is overlain in turn by the Doian culture which gradually evolved from it. Tool types include a few rather large backed blades ; numbers of straight backed microliths with characteristic basal retouch ; crescents ; very characteristic small and finely made limace points ; typical Magosian sub-triangular points ; *lames écaillées* ; small slender unifaced points with triangular section ; facetted flakes ; bi-polar cores ; small disc cores and an occasional sub-triangular type core. The large disc scrapers and end-scrapers of the Hargeisan are entirely lacking but a few diminutive end-scrapers occur and thumbnail scrapers are also rarely found. Burins are rare and when found are of *bec-de-flute* or polyhedric type ; angle-burins do not occur.

The Somaliland Wilton. The derivative of the Hargeisan in the north is the Somaliland Wilton ; the type series comes from a rock shelter, the Gumbur Todoballa, at Mandera where this culture underlies a detrital deposit of wall flakings and fine wind blown sand. Tool types include fairly typical, but rather poorly made

DISTRIBUTION MAP OF PREHISTORIC SITES IN THE HORN OF AFRICA

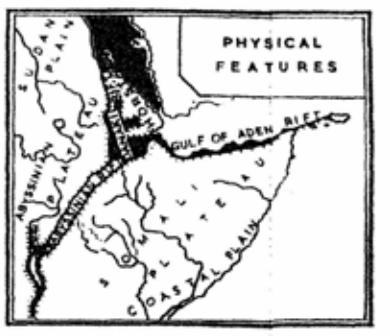
LEGEND

- ● AUTHOR'S SITES
- ○ OTHER SITES
- X OTHER SITES OF UNCERTAIN LOCATION
- ◑ ROCK PAINTINGS
- ◐ ROCK ENGRAVINGS
- TERRITORIAL BOUNDARIES

SCALE 1:2,000,000

0 20 40 60 80 100 200 KILOMETRES

20 10 0 20 40 60 80 100 120 140 MILES



JDC 12.12.46

Wilton crescents, small backed blades, thumbnail scrapers, and small end of blade scrapers. Pottery should probably be associated with this culture and now appears for the first time, except for some sherds found in rather doubtful circumstances that might perhaps be assigned to the Hargeisan. These Wilton industries which are of Kenya Wilton B rather than Wilton A type, appear to be widespread on the Harar plateau and at the Bourg de Bozas sites. The Wilton is found in the Danakil and Abyssinian Rifts and is present also in southern Abyssinia at Yavello.

Of the main variants, that at Giglei in the middle Webi Shebeli exhibits largish backed blades and microliths to the almost total exclusion of all other forms of tool. At Rakan, hollow-based arrowheads and small pressure flaked points indicate a development into a neolithic variant.

Strandlooper forms also occur along the eastern seaboard. Typical is the material from a rock shelter at Beide at the mouth of the Nogal, where a poor industry was found in a shell midden consisting of a number of unworked primary flakes, an occasional crescent and backed blade, a rare and crude point, and large bifacial chopping tools or picks made from pebbles, the latter apparently an essential tool of a strandlooping existence.

The Doian Culture. In the south and centre the Somaliland Magosian gradually develops into a local rather specialised series of industries showing some interesting variants. Local parallel development is now more apparent than in any of the preceding cultures and the term Doian has been applied to these Late Stone Age industries, named from the Somali word '*Doi*' used to describe the flat, scrub-covered red sand country of southern Somalia in which many of these factory and living sites have been found.

The type sites are the Gure Warbei (Bur Eibe) and the Rifle Range site at Bur Hakaba which latter has yielded some fragmentary human remains in addition to the cultural material. The material culture consists of small well made leaf-shaped points and *limaces* exhibiting typical controlled pressure, or neolithic, technique and crescents and backed blades which exhibit Heluan-type retouch. Certain rare forms show a bossing accentuated by concave shallow backing. Diminutive unifaced points, long and slender and markedly sub-triangular in section occur, of which a variant is the trihedral rod, a tool in which the working has been carried over all three faces and similar to implements of this kind first recorded by Miss Caton-Thompson from the Fayuum B culture of Egypt. A rare form is an equilateral triangular tool,

pressure flaked over both sides, which is the prototype of the hollow-based arrow-heads best developed in the Mudugh variant. Microliths are common and numbers are about equally divided between the straight backed form and the crescent. Ostrich egg and other shell beads occur, as also do pestle and rubbing stones. Pottery is probably to be associated at the very end of the Doian occupation.

The main variant is found at Mirsale in the Mudugh where numbers of largish crude 'points' of bifaced foliate form predominate and are present in greater numbers than at other sites. A strandlooping form also occurs.

This completes the Stone Age succession, which appears to have persisted in places into comparatively recent, and it is believed, historical times. Existing evidence does not conflict with the suggestion that the original stock of the slender boned, small statured, negroid hunting groups of southern Somalia may be the descendants of the Late Stone Age population who were displaced by Hamitic immigrants—the Galla and later the Somalis —from the north-west. These small nomadic groups of which the Bon and Ribi and some of the Eile are the purest examples, still live predominantly by hunting, pursued with the aid of dogs and nets. Certainly it is tempting to see a connection between the stone triangular and hollow-based arrowhead and the leaf-shaped specimens from the Doian, on the one hand, with the triangular and leaf-shaped iron heads of the present day hunters; the similarity is striking. The centre of diffusion for both is the Southern plateau.

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KEY TO DISTRIBUTION MAP OF PREHISTORIC SITES IN THE HORN OF AFRICA

1 Berbera Rock Shelter
2 La Ferug
3 Hargeisa
4 Giggiga
5 Borama
6 Aisha
7 Adele
8 Carasleh Tug
9 Adjin
10 Haud Surface : Aware
11 Mandera
12 Balleh Bie Mudo
13 Khansa Au Plain
14 Dubar
15 Guban Plain : Berbera
16 Hammas
17 Bur Degis
18 Bur Eibe
19 Bur Mahamudo
20 Bur Hakaba
21 Warishe
22 Gawan wein
23 Deileb
24 Wanei
25 Isha Baidoa
26 Manase
27 Hoddur
28 Wejit
29 Madeida
30 Legullei
31 Morogavi
32 Alamo
33 Far Abou
34 Bohol Washago
35 God'dere
36 Ato
37 Saha Gurral
28 Ted
39 Burdo
40 El Dubbo
41 Sijjia
42 Ohole
43 Goffado
44 Rakon
45 Mirsale
46 Daba Gallo
47 Afgedut
48 Gowein : mile 27 from Obbia
49 Obbia
50 Kourou
51 Dusa Mareb
52 Donkukoq
53 Laba Higlo : mile 14 from Garoe
54 Garoe Tug
55 Hararile : mile 44 from Eil
56 Eil
57 Biede
58 Got Ad
59 Babani Tug
60 Bihen
61 Jid Banan
62 Domo
63 Wardere
64 Gherlogubi
65 Gabredarre : Tug Fafan
66 Kaptinag
67 Damburwein
68 Durualeh
69 Kabahan
70 Melka Taka : Bama'asi Cave
71 Melka Taka : We Shebeli
72 Oura Ba'ad
73 Darchaua Tug
74 Bur Eighei
75 Mile 32 Callafo/Mustahil Road
76 Durdere : mile 18 Callafo/Mustahil Road
77 El Goran
78 Bohol Bandoi
79 Daban
80 Habr Fordisso
81 Durdur Heime (Dondere)
82 Fossil Dune : 7.6 miles from Duldir
83 Sheik Gure
84 Bugda Acable
85 Jesomma
86 Bulo Burti
87 Cesira
88 Danane
89 Mogadishu
90 Bardera
91 El Colcolo

92 Berdale
93 Mile 75 Wajir Road
94 Salagle
95 Bun Mess
96 Bur Mun
97 Bur Dinsor
98 Allengo
99 Guretca
100 Lugh Ferrandi
101 Dolo
102 Washaga Guran
103 El Ure
104 Mahaddei wein
105 Between Belet wein and Tijieglo
106 Mustahil
107 Adad
108 Ilbehla
109 Durgale
110 Adani
111 Warandi
112 Hill 49Km from Gorrahei
113 Ubitale
114 Wal wal
115 Bio Addo
116 Daghabur
117 Galkayu/Garoe Road: about 60Km from Galkayu
118 Between Galkayu and Garoe
119 Upper Nogal
120 Deavani
121 Trogo Dait
122 Gulule Tug
123 DolDol Plateau
124 Between Bakbah and Ariri
125 Between Bihen and Ariri
126 Bihen
127 Between Bender Beila and Bihen
128 Between Warassimoghe and Bender Beila
129 Badi Admud
130 Cubo
131 Between Martissor Dunti and Scerer Hor
132 Ras Hafun
133 Lower Darror
134 Upper Darror
135 Ras Filluc
136 Taleh
137 Buran
138 Hobat
139 Hormo
140 Erigavo
141 Sheik
142 El Anod
143 Tug Issutugan
144 Between Zeila and Berbera
145 Ras Kiro
146 Between Gulf of Tajura and Lake Assal
147 Gulf of Tajura
148 Kor Ali
149 Mount Mabla
150 Obok
151 Djebel Djinn
152 Porc-Epic Cave, Dire Dawa
153 Segag
154 Fidaedi
155 Orahut
156 Dallahale
157 Tug Ensiral
158 Hababule
159 Dakata/Webi confluence
160 Left Bank of the Webi Shebeli
161 Left Bank of the Webi Shebeli
162 Left Bank of the Webi Shebeli
163 Daghabur/Webi confluence
164 Left Bank of the Webi Shebeli
165 Suri
166 Oksa
167 Guerkifton
168 Iddi
169 Dabrin
170 Karsalek
171 Gilohanno
172 Rahaitu
173 Robabuta
174 Abbe
175 Ghimir
176 Kagiua
177 Goba
178 Sheik Hussein
179 Valley of the Tug Sullul
180 Bed of the Tug Dakata: 20Km above confluence with Daure Tug
181 Las Anod
182 Kirit
183 Bohotle: Merken wein Balleh
184 El Dur Elan
185 Ragunda Tug
186 5 miles from Hudin: Hudin/Ainabo Road

187 Bur Khansa : Bihen (Hubera Valley)
188 Halin
189 Haded Bal Ad
190 Shimber Beris
191 50 miles from Las Anod : Las Anod Halin Road
192 12 miles from Hudin : Hudin, Halin Road
193 Sunto
194 Al Mills
195 Teisa Tug
196 Arabsiyo
197 Gebile Tug
198 Ijara Tug
199 Sirrau Balleh
200 45 miles from Hargeisa : Hargeisa/Wardere Road
201 Dudobo Coffee Shop
202 Ged-Dobo
202 Haleya
204 Skutar
205 Jifa Ure
206 Alablah Balleh
207 Genda Biftu : Surre
208 Harar
209 Gerbakele Shelter
210 Balleh Shelter
211 Dombosleh Shelter
212 Skutar Shelters
213 Dukokolel yero
214 Bur Dahir
215 Gedeis
216 Manjasseh
217 Tug Argan
218 Darbruk
219 Ruchessa (Roukatcha) Wells
220 Omerdin
221 Lago Oda
222 Taffe
223 Arawe
224 Warka
225 Ciallanco (Tchalinko)
226 Collubi (Culubi)
227 Curgum (Kour Kourron)
228 Dobasso (Dabasso)
229 Lake Adili
230 Dubato

SUB-DIVISIONS OF THE PALAEOLITHIC

A. RUHLMANN

The old classification of the Palaeolithic sub-divided it into three. The *Lower* Palaeolithic, which included the Chellean and the Acheulean, corresponded to the one warm period. The *Middle* Palaeolithic, representing the only flake industry then known—the Mousterian—belonged to the one cold period. The *Upper* Palaeolithic, comprising the Aurignacian, the Solutrean and the Magdalanian, was identified with the post-glacial period. The subdivision of the Palaeolithic into three periods was arrived at, therefore, by relating these three phases with the industries, classified into hand-axe, flake and blade industries.

It has now been established that the oldest known industries in western Europe belong not to a last interglacial (Riss-Würm) but to the first interglacial (Günz-Mindel). We also know that flake industries associated with warm faunas existed before the classic Mousterian. Industries with different techniques developed all through the glacial periods, but especially during the interglacials. During this long period of our earth's recent history, industries—sometimes hand-axe, sometimes flake, sometimes mixed—appeared, developed and disappeared together with different human types and faunas alternately warm, cold and finally temperate.

In the course of this general and continuous development, no archaeological, palaeontological and above all geological distinctions comparable to those which serve to distinguish the Lower and Upper Palaeolithic, exist to justify the use of the term ' Middle Palaeolithic '. If it is agreed that the arrival of Quaternary times in Europe—the Lower Pleistocene of the geologists or the Lower Palaeolithic of the prehistorians—is signalled by the development of great glaciers, and the end—the Upper Pleistocene or Upper Palaeolithic—by their retreat, it is difficult if not impossible from the archaeological point of view to isolate a Middle period or phase in this succession. Convenient though the term Middle Palaeolithic may be, applying to an intermediary period, it does not really exist and its ambiguity has led to confusion.

It is therefore proposed to retain but two terms : the Lower Palaeolithic and the Upper Palaeolithic. In this classification the Lower Palaeolithic includes all hand-axe and flake industries, from the very earliest at the beginning of Quaternary times to

those which are contemporaneous with the last glaciation (Würm) In other words this period ends in western Europe with final Levalloisian (VII) or with the classic Mousterian according to the region. The Upper Palaeolithic includes blade industries characteristic of the post-glacial phase, when the Würmian glaciers had retreated more or less to their present limits.

In the North African region the glacial periods were represented by pluvials. Here the Lower Palaeolithic includes the earliest industries—the Clactonian, Clacto-Abbevillian or Abbevillain, again according to the region concerned—and ending with typical Mousterian contemporaneous with the last (or fourth), pluvial. In the Upper Palaeolithic are classed industries of a final Mousterian type with a particular evolution—the Aterian—and in S. Tunisia and S. Constantine those of an early Capsian and a middle or classic Capsian synchronising with the post-pluvial period.

The Upper Capsian, however, together with its coastal equivalent, the Ibero-Maurusian (Oranian) belongs both chronologically and archaeologically to the transitional or Mesolithic phase.

It is impossible to judge the duration of the immensely long first phase of man's prehistory—the Lower Palaeolithic—in spite of the attempts of various authors to do so, but it must certainly involve many hundreds of thousands of years. In contrast with this very long period, the Upper Palaeolithic, which is characterised anthropologically by the presence of *Homo sapiens* fossils—the Neanthropus of British authors—was very brief. For Western Europe it is estimated at 15–20,000 years.

There is then an enormous chronological disproportion between the two great evolutive phases of the Palaeolithic, but it is unnecessary on this account to introduce a third sub-division : that of the Middle Palaeolithic. The great length of the first of these two phases reaffirms strongly a judicious remark made by l'Abbé Breuil : ' the extraordinarily slow upward progress of humanity '.

TERMINOLOGY OF THE INDUSTRIES OF THE LOWER PALAEOLITHIC

L. Barradas

THE DEVELOPMENT OF THE HAND-AXE CULTURE IN SOUTH AFRICA

C. VAN RIET LOWE

While it is now widely held that the essential home of the Hand-axe Culture is to be sought in Africa, we find, when we set out in search of its roots that as soon as we leave this continent we flounder in mists of uncertainty. If, on the other hand, we remain here, we find that here—and here only—we have a long series of earlier well stratified cultures which lead us naturally and directly to the establishment of the Hand-axe Culture. When we add to these the remarkable discoveries of Dart and Broom in South Africa, of Leakey in East Africa, of Wayland in Central Africa and of Neuville (1941) and Ruhlmann (1941) and others in North Africa, we find that the only reasonable working hypothesis we can adopt at this stage is to regard this continent as the most likely centre of the origin of tool-making man.

The remarkable discoveries of Wayland in Uganda have revealed the existence of a pre-hand-axe culture that antedates the appearance of the Oldowan of East Africa and elsewhere. This simple Kafuan Culture was found to include four stages of development, each stratigraphically separated from the other and the whole in deposits recognisably older than those which are known to have yielded artefacts of Oldowan type. Kafuan-type artefacts have been found as far north as Khartoum and as far south as the Vaal where they occur in comparative abundance in deposits geologically older than those which have yielded remains of the first stage of the development of the Hand-axe Culture.

When I use the expression ' the first stage of the development of the Hand-axe Culture ', I imply a material culture the finest products of which include comparatively crude bifaced tools of Chellean or Abbeville-type. It must however be immediately remembered that the first or Chellean stage of the development of the Hand-axe Culture north of the Pyrennees is not the same as the first stage of the development of the South African counterpart of this culture ; nor is it the same as the North African (Neuville and Ruhlmann, 1941) and Portuguese (Breuil and Zbyszweski, 1942) which are almost mirror-images of the South African. In this continent, along its northernmost shores in Morocco as well as along its southernmost shores in the Cape of Good Hope and its south-eastern shores in Portuguese East Africa (Van Riet Lowe and Breuil, 1944), we find that the first stage of the Hand-axe

Culture contains tools of both Chelles- and Clacton-type integrally associated in a common cultural whole. In other words, African manufacturers of the first recognisable hand-axes made their tools —axes, cleavers and scrapers—on cores or flakes as they willed, using both direct freehand and direct rest or block-on-block percussion techniques as these terms were used by Holmes (1919)[1]

The employment of both these so-called ' core ' and ' flake ' techniques by the same people at the same time is most striking in Southern Africa where the first stage of the Hand-axe Culture is no more directly comparable to the Chellean or Abbevillian of France than it is to the Clacton of England, but is strikingly similar to the Clacto-Abbevillian of Morocco and Portugal.

What the precise geological horizon of the earliest stage of the Hand-axe Culture in South Africa is, we can unfortunately not yet say. No remains of contemporary fauna which might have aided us have yet been discovered. It is known however, to have been practised during a climatic cycle which preceded the aggradation of certain gravels in the Vaal river basin which do contain an abundant fauna of Middle Pleistocene Age (Cooke, 1946). It is therefore suspected and may yet be found to be comparable in age to the first Pleistocene Pluvial of East and East-Central Africa and to the first major advance of the Pleistocene ice sheet in Europe. There can be little doubt however, that the Hand-axe Culture in Southern Africa is no less ancient than is its classic European counterpart.

The Hand-Axe Culture

(1) *Stage One* : From a broad typological point of view, the first stage in the development of the Hand-axe Culture in South Africa is characterised by two types of bifaced tool : the first is a more or less pear-shaped hand-axe made from a water-worn pebble or ' core ' ; the second is a similar tool made from a flake struck from a pebble or small boulder.

(i) *Hand-axes on Cores* : Maximum length, breadth and thickness seldom exceed five, three and two-and-a-quarter inches respec-

[1] By direct freehand percussion is meant fracture by striking the stone being trimmed, held in one hand, with another, held in the other hand and thus purposely flaking the former into the desired shape ; by direct rest percussion is meant fracture by striking the stone against another usually larger and stationary stone.

In the former, scar-beds are generally deep and the angle between the striking-platform and flake surface variable ; in the latter scar-beds are also deep, struck flakes consistently have marked bulbs and often semi-cones of percussion, and the angle between the striking platform and main flake surface is consistently obtuse. In other words, the direct rest percussion, ' anvil ' or ' block-on-block ' technique, whatever we may choose to call it, consistently gives rise to ' Clacton ' flakes which necessarily abound whenever this technique was practised.

tively. Negative flake scars are generally deep, wide and steep. Few specimens contain more than ten negative scars arranged in twos and threes along the zig-zag edges of obverse and reverse faces. Much of the original pebble cortex is often left at the blunt or butt end.

(ii) *Hand-axes on Flakes*: Equally abundant on factory-sites or living-floors are similarly crude hand-axes made from large flakes removed by direct rest percussion or the block-on-block technique and therefore with markedly obtuse angles between the planes of the striking-platforms and main flake faces, *i.e.* they are Clacton *in form*.

The only important difference between the 'core' and 'flake' bifaces is one of comparative asymmetry in cross-section. Bifaced hand-axes made from 'cores' are markedly biconvex, whereas those made from Clacton-type flakes have one flake face.

At the type-station in the 50 ft. terrace of the Vaal at Vereeniging, pebble or 'core' and flake type hand-axes occur in equal abundance and, with rare exceptions flakes are of the wide-angled Clacton variety.

(iii) *Polyhedral Stones*: Next in numbers are many-facetted, roughly polyhedral artefacts which average between three and four inches in diameter: the largest being about five inches, the smallest less than three. The great abundance of these artefacts on factory-sites and the frequently bruised and battered nature of ridges or arrisses suggest that they were used as fabricators or hammer-stones where one of the shaping processes was direct freehand percussion. It is however, equally possible that the smaller specimens were bolas-stones used in the chase.

(iv) *Cleavers*: These are uncommon. They occur on wide-angled Clacton-type end-flakes derived by the block-on-block method. Secondary trimming is slight and was apparently achieved either by direct rest or by direct freehand-percussion—both techniques being employed.

(v) *Scrapers*: Both end- and side-scrapers occur. Flakes are generally Clacton in form and secondary trimming is slight, coarse and steep.

(vi) *Cores*: Cores occur sporadically. They are simple water-worn pebbles from which flakes were removed apparently by striking the core, held in one or both hands, against an anvil. The first negative flake scar was used as a platform for the removal of the next flake from the opposite face. As flakes were removed from the outer edge of the core toward the centre and as both faces are scarred, the effect on some of the cores is to give them a

pseudo-Levallois appearance. As there is no evidence of any deliberate preparation of striking-platforms, the process bears no relation to the 'Levallois'; it is merely *pseudo*-Levallois. Nevertheless the most interesting fact emerges that the makers of the tools that characterise the first stage of the development of the Hand-axe Culture in South Africa were masters of core and flake techniques which combine to make the culture comparable only to an admixture of European Chellean or Abbevillian and Clacton tool-types and techniques as these are interpreted in Europe.

This was *one* of the reasons why South African prehistorians were influenced to discard the European terminology and experimentally to adopt their own. It was at the 1926 Annual General Meeting of the South African Association for the Advancement of Science that it was resolved to name the South African counterpart of what was at that time known as the Chellean Culture, the Stellenbosch—after the type-station at Stellenbosch in the Cape of Good Hope. I need not remind you that the existence of the Clacton Culture was not even suspected at that time. You will therefore appreciate the difficulties in which we found ourselves. We had Chelles type 'core' tools in great abundance in apparently equally old or possibly older geological deposits, but with them we had an equal abundance of 'flake' tools integrally associated in a common cultural whole.

The recognition of the inadequacy of the term 'Chellean' as applied to a well-stratified cultural entity resulted in its recent replacement by the term 'Abbevillian' for what European prehistorians still regard as an independent 'core-culture'. In addition, the comparatively recent identification of the supposedly independent yet contemporary Clacton 'flake-culture' in Europe and the confusing applications of the theories which underlie their recognition show, I submit, how wise was the course taken by us in the South so many years ago.

While the cultural differences to which I have referred, viz. the Stellenbosch *vis à vis* the Chellean or Abbevillian and the so-called Clacton are undoubtedly important, they are by no means unexpected. Even within the half-million square miles of Southern Africa, the Stellenbosch Culture shows differential developments as we pass from the characteristic raw materials and environment of the high interior to the low-lying coastal regions. The first stage in the development of the Hand-axe Culture in the basin of the Vaal does not differ markedly from its counterpart in the Cape, but the second, third, fourth and later stages show progressively greater differences when we compare the total yield from sites a

thousand more miles apart. So much has this been found to be the case that even within the Union we have been obliged to distinguish a *Vaal* Stellenbosch from a *Cape* Stellenbosch—less than one thousand miles apart. These differences will become more apparent as we proceed to trace the development of the Culture through its various stages, using the occurrences in the Orange, Vaal and Limpopo river basins as our criteria.

(2) *Stage Two*: This is a stage about which we unfortunately know very little, for we have no unadulterated site. Its description depends very largely on typological consideration which may well have given rise to misleading conclusions. Nevertheless it would appear that at this stage of human progress we pass from Abbeville—to Early Acheul-type hand-axes and so possibly from what Leakey once identified as a ' stone-on-stone ' to a ' wood-on-stone ' technique.

Heavy almond-shaped hand-axes now predominate; secondary trimming is more refined and intensive ; edges are more regular and negative scars are no longer always so deep and steep. End-struck cleavers occur in greater numbers and side-struck cleavers appear for the first time. Direct rest and direct freehand percussion methods continue—but with marked refinements.

When we find tools of this stage mixed with those of the first, they are less weathered and worn ; when we find them mixed with those of the third stage, *i.e.* in a derived state, as we frequently do, we find they are more weathered and worn than are their later bed-fellows. This is the only clue to their position in the natural order to events. Nevertheless as they always occur rolled in the first group of Younger Gravels in the Vaal, they were obviously derived from an older geological horizon and must therefore antedate the Stage 3 tools which belong to the period of the earliest aggradation of the Younger group of gravels.

We have a few asymmetrical cores which are still pseudo-Levallois in form, but which show a continuation of the core-cum-flake methods and aims of their predecessors.

It should be pointed out that when we know more about this stage, we may find that it will need to be divided into sub-stages. The differences between assemblages from Stages 1 and 3 are so marked that I suspect that what we now call Stage 2 may in reality represent several stages in the development of man's skill.

(3) *Stage Three*: This stage is primarily marked by a great advance in flaking methods—an advance which enabled man to make a remarkable variety of hand-axes and cleavers.

(i) *Hand-axes*: The hand-axes include varieties of single-pointed almond shapes, double pointed or limande types, occasional ovates and thickish, long-pointed pick-like types. Some of the hand-axes are very large and exceedingly well made. Notable among these are the long-pointed uncinate or ovate-acuminate types which occasionally exceed a foot in length and are very similar to specimens which characterise Stage 4 of the Kenya Acheulean. (Leakey, 1936).

(ii) *Cleavers*: Both end- and side-struck cleavers continue, the side-struck predominating to such an extent as to be the most characteristic tool of this stage. The finished cleaver is usually *U*-shaped, but square-butted specimens are not uncommon. Some have flared working edges while one isolated specimen is entirely fish-like in shape. (Van Riet Lowe, 1945).

The most typical cross-section is a parallelogram, both obverse and reverse faces being positive flake faces with bulbs of percussion diagonally opposed to each other. This means that this highly specialised tool was made from a flake struck from a core *which was itself a flake*, the process of manufacture being: (i) the removal of a large wide-angled flake from a core utilising the negative flake scar of a previously struck flake as a striking platform. The largest *primary* flake of this type I have seen is the size of a large leg of veal and weighs over 30 lbs.; (ii) the removal of the slender end of this flake (remote from the bulb) by a blow delivered at a right-angle to the main flake face in order to get a suitable striking-platform for (iii) the removal of the large final flake from what was left of the first flake by a blow struck diagonally opposite, but slightly to one side of the first blow. The result is a flake with two intersecting positive flake faces at one edge (the 'cleaver' edge) and two diagonally opposed positive bulbs on opposite faces.

The extraordinary skill demanded of a maker of such tools is most striking. The Abbé Breuil felt compelled to admit the possibility of man's knowledge of such a mechanical contrivance as a well-loaded, stone pendulum which could be aimed and swung with comparative accuracy at a fixed core. We cannot possibly regard those who had the imagination and skill to make tools of the type that characterise Stage 3 as 'brutal'; it is more reasonable and sane to suspect that we have before us the skill of sapient man. The next most characteristic artefact of this stage is that elaborately prepared core first described by Jansen as a '*hoenderbek*' or 'fowl-beak' type (1926) (Victoria West I or Proto-Levallois I), a core from which flakes of controllable shape and size were struck by a well-aimed blow against a prepared striking platform; the

flakes thus struck being converted into hand-axes, end- or side-struck cleavers and scrapers as the maker willed. All have facetted striking platforms. It is in this technique that we first meet the undoubted roots of the Levallois—a technique that is an integral part of Stage 3 of the development of the Hand-axe Culture in South Africa : a culture which, in turn, is typologically comparable to Stage 4 of the East African Acheulean and belongs possibly to Middle Pleistocene times.

(4) *Stage Four* : Stage 4 is characterised by a variety of hand-axes and cleavers made from end-struck flakes derived from specially prepared Proto-Levallois II (or Victoria West II) cores. These were first described by Jansen (1926) as '*perdehoef*' or 'horse-hoof' types. The cross-section of the most characteristic axe and clever is, in consequence, a trapezium.

Except for the absence of the long-pointed type of hand-axe, the profiles of well-finished bifaced tools do not differ profoundly from those of the earlier Stage. In such cases cross-sections are consistently lenticular. As often as not, however, the flake struck from the specially prepared proto-Levallois II core needed only partial trimming on the main flake face ; intensive trimming was undertaken on the opposite face only, leaving a tool with a trapezium- or segment-like cross-section. Striking platforms are again facetted.

A few of the high-backed pyramidal cores of this Stage bear a striking resemblance to those of the Old Levallois of Western Europe, viz. Levallois II, but they lack the refinements of their European 'counterparts'. Nevertheless they clearly indicate the emergence of a technique that is basic to the Levallois of Europe *within* the Hand-axe Culture in South Africa. (van Riet Lowe, 1945). Among the cores of this Stage, we have a few which clearly indicate the deliberate manufacture of blades.

(5) *Stage Five* : Well stratified within the sequence of the development of the Hand-axe Culture in the Union are the tools that characterise the fifth and final phase.

(i) *Hand-axes* : These vary considerably in size and shape—the largest recorded specimen being over a foot in length, just over 4 inches in breadth and three inches in maximum thickness ; the smallest (a true almond shape) just under 4 inches in length, two in breadth and less than one inch in maximum thickness. In most specimens the edges are straight, but several have been found with markedly S-like twists. In addition to these almond-shapes, we have many which are pick-like (Leakey's 'Tumbian'), cordiform

(for the first time), long slender-pointed ' Larsen- ' types (van Riet Lowe, 1937), ovates and limandes. The workmanship of finished specimens is exceedingly fine.

(ii) *Cleavers* : Much refined, but typical Stage 3 and Stage 4 type cleavers continue ; Stage 3 types predominating, *i.e.* cleavers made from twice side-struck flakes.

(iii) *Gravers*-cum-cleavers : These have been fully described. (van Riet Lowe, 1937).

(iv) *Scrapers* : End-, side- and hollow-scrapers are not uncommon. These are consistently on flakes, the majority of which are wide-angled Clacton types.

(v) *Polyhedral Stones* : Many-facetted or polyhedral stones similar to those of the earlier stages, continue.

(vi) *Cores* : The most significant of the cores is the European Levallois II type. The occurrence of these *prepared* cores at this level (Middle to Upper Pleistocene) shows conclusively that *the Levallois developed as a technical process within* the Hand-axe Culture of South Africa. The Pre-Levallois cores of Stages 1 and 2, the Proto-Levallois I and II of Stages 3 and 4 and the Old Levallois of Stage 5 reveal successive stages in the development of a *technique* which is integrally associated with the development of hand-axes.

There can be no question that the Levallois is *not* an independent culture in South Africa, nor can there be any question that while European prehistorians insist on regarding it as an independent flake-culture which developed contemporaneously with the Hand-axe (' core ') Culture in that continent, we cannot satisfactorily correlate the European with the South African occurrences —unless time shows, as I suspect it may, that the prevailing European interpretation of the Old Palaeolithic Age in that continent is incorrect.

(6) *Subsequent Stages* : The geological deposits that separate remains of the underlying Stage 5 from remains of later Stages are most important. They include (both in the interior and near the coast) thick deposits of highly calcified sands which reveal : (i) a silting up of rivers while men who made tools of the fifth stage were still living in the area, (ii) the complete calcification of the silt which in instances, is known to exceed 40 ft. in depth *after* the area had been deserted, and (iii) the erosion of the calcified sand to re-expose Stage 5 tools lying on and immediately over the basal gravels. The climatic episode which is reflected in the deposits which separate Stage 5 from the later stages is thus seen to have been one of no mean significance.

The hand-axes, cleavers and other tools which are found in and over this thick blanket of calcified sand belong to what is known in Africa as the Fauresmith Culture. They reveal successive refinements of the Levallois technique more or less as represented in Europe by Levallois V, VI and VII, but with differences which have been fully described (van Riet Lowe, 1945). Our Stages 6, 7 and 8 are known in the Union as the Early, Middle and Late Fauresmith—a culture in which we find the Levallois fully developed *as a technique*. In the final stage of the Fauresmith and thus in the final stage of the Hand-axe Culture our Levallois-type cores include the following forms : circular, cordiform, sub-triangular, rectangular and pyramidal—cores which reveal a mastery over both flake and blade techniques.

With the final stage of the Fauresmith with its fine Micoquian-type tools and well developed Levallois technique, we come to the end of the Hand-axe Culture.

Conclusions. When we review the development of the Hand-axe Culture, what do we see ? It is submitted that the most outstanding feature is not the gradual perfection of the bifaced hand-axe in its various forms so much as the underlying technical processes and refinements which are integral features of the Culture.

In the beginning we see the African counterpart of the Chellean or Abbevillian with a mass of ' core ' and ' flake ' waste-products which in Europe would be assigned to a separate culture, viz. the Clacton, which here is not a culture at all ; then we see the African counterpart of the Acheulean developing, as in Europe, through a number of stages with a mass of waste-products which in Europe would be assigned to a separate culture, viz. the Levallois, but which also is clearly not a culture here at all.

The South African artefacts which completely parallel and typify the European ' Flake Cultures ' were the result of techniques employed *within* the Hand-axe Culture to enable man to make the bifaced tools he needed. This contribution should be read in conjunction with ' The Evolution of the Levallois Technique in South Africa ' (van Riet Lowe 1945) ; also Goodwin (1935) and Malan (1946).

If my original premise that the home of the Great Hand-axe Culture is to be sought in Equatorial Africa is correct, and if its corrollary holds good—as it must—that this Culture was spread over the Old World from Africa, we cannot reasonably expect the earlier European divisions to be faithful mirror-images of their South African counterparts. Both these regions are remote *culs*

de sac from the main stage (which all the evidence before us suggests is to be sought in the Equatorial Region), and in each of these *culs de sac* man had to adapt himself and his skills to different environments and raw materials which undoubtedly influenced not only his own development, but also the development of his techniques.

The African continent should therefore be given precedence over that which has hitherto dominated the field of prehistory. Therefore if at this Congress it is resolved to retain the classic European terminology *which I think is desirable in the case of the Old Palaeolithic only*, we should devise terms with prefixes which not only reflect differential developments in continental extremes, but which also reflect common origins and ties or affinities.

I therefore submit that there should be no Chellean or Abbeville Culture *per se*, but rather a French Chellean or Abbevillian, an Iberian Chellean or Abbevillian, an East African Chellean or Abbevillian and so on—particularly a French Chellean—not merely a Chellean; the Acheulean to be adapted in the same manner. After the Acheulean, there can be no question that all cultural terms demand establishment regionally and independently, for toward the end of the great Hand-axe Culture man would appear to have penetrated to and established himself so thoroughly in such remote regions that trans-continental contacts must, if they took place at all, necessarily have been so slender as to render all subsequent resemblances merely fortuitous.

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Friday, January 17th

THE STONE AGE IN BECHUANALAND

E. J. WAYLAND

A CHRONOLOGY OF THE QUATERNARY IN SOUTHERN MOÇAMBIQUE

LERENO A. BARRADAS

SOME PALAEOLITHIC SITES IN THE DISTRICT OF GAZA

In this area there are many Palaeolithic sites, varied as regards topography, geology and the nature of their industries, which, owing to their particular characteristics, yield valuable information for the study of the chronology of the Quaternary in Southern Moçambique.

(A) MAGUDE

This site is a classic one in that it forms a landmark in the chronology of the Quaternary. It is covered by the town of Magude and was first discovered in a railway cutting which connects the bridge over the Incomati with Magude station.

A section at the station displays a layer of sandstone believed to be Tertiary, on the surface of which lie implements totally covered by a layer of red sands, which at certain points reaches a thickness of 4 metres. The sandstone which forms the escarpment on the Incomati shows on its surface traces of strong marine abrasion, with potholes sometimes with horizontal adits. Nowadays the surface is 57 metres above sea level and 20 above the normal flood plain of the Incomati. It is 60 kilometres from the sea.

The implements and flakes referred to above are at times cemented into the sandstone and covered by a thin layer of yellow siliceous clay. As a rule the implements are unrolled and belong mainly to the Upper African Acheulean and even to the Fauresmith. It is worth noting that some rolled implements are found which belong to previous and uncertain industries, while others are contemporary with the deposition of the sands. The succession of events at this site, as at others to be described later, is shown in Tables I and II.

(B) MARIJARINGA

Marijaringa is the name of the lagoon situated near the limestone quarry at present being mined for the manufacture of cement. The railway siding of Mangulane on the right bank of the Incomati leads to the sites, which may be distinguished as follows :

(i) MANGULANE QUARRY

The geological profile at this site includes layers of Tertiary limestone, now being quarried, with which the Magude sandstone comes into contact. On top of the limestone is a layer of pebbles or rolled boulders, nearly 3 metres thick, which are covered by a layer of red sand 8 metres thick, similar to the ones at Magude.

The irregular surface of the limestone, 87 metres above present sea level and 50 kilometres from the shore line, shows signs, though somewhat doubtful, of marine abrasion.

In the layer of rolled pebbles two formations can be distinguished :

(*a*) A lower one made up of blocks of strongly cemented conglomerate, irregularly scattered throughout.

(*b*) The upper formation consists of pebbles approximately the same size, the crevices of which are filled with red sands which provide a weak cementing medium. This layer has the characteristic of presenting a furrowed surface, due no doubt to the way in which it was deposited.

Both layers contain an industry, perhaps Lower Oldowan, with rare bulky implements very rolled and deeply patinated. On the upper layer and parallel to the irregularities of the surface, can be found an Upper African Acheulean industry. The artefacts are less abundant here than at Magude, but include perfect and typical unrolled implements and flakes which show a certain similarity with those at Magude, although the level of the sea is much higher (see Table II).

(ii) Bandoia A.

Costa's trading store at Bandoia is built on a Quaternary terrace of fluviatile origin, which follows the road from this place to Mangulane Quarry, along the lagoon. At a certain point on the road, 10 metres above the flood plain, there is an outcrop of Magude sandstone which also shows signs of marine erosion, although the height above sea level is different (70 to 57 metres).

There seem to be industries earlier than those of Magude in a bed lying between 5 and 8 metres above the normal flood plain, which is enclosed between the eroded sandstone and the quarry. These rolled implements are apparently early Acheulean, intimately mixed with Clactonian. There are also unrolled implements of Lusitanian type. In the vicinity of the quarry there are higher terraces containing mixed industries contemporary with Bandoian B and at the same elevation.

(iii) Bandoia B.

This site is at a higher level than that of Bandoia A, 15 to 20 metres above the flood plain of the Incomati, and has yielded many interesting implements ranging from Oldowan to Acheulean. The site consists of an accumulation of river pebbles at the point where the road begins to climb towards Moamba, after a tract of low ground through which the waters of the lagoon are discharged.

Implements of Oldowan type are strongly rolled and deeply patinated, sometimes with a red patina ; those of Acheulean type have not been affected so strongly, although they too seem to have been rolled. The formation of the terrace, which is character-

istic of its type, must be pre-Acheulean and was deposited during the third advance of the sea (Period V).

(iii) Mangulane Kilns

This site deserves special attention as it is connected with the layer of limestone described by Engenheiro A. Borges as : ' a calcareous crust with a brecciated concretional structure containing rolled pebbles at certain points. This site must have had a lacustrine origin, as verified on the walls of a kiln under construction, where the limestone contains very well preserved terrestrial gasteropodae, which still exist in this area.' The beds are due to an arid climate and must be similar to many others which form terraces on the banks of the most important rivers.

As the implements are covered with lime, it follows that if they are Acheulean, the deposition of limestone must be post-Acheulean (Period IV, second retreat of the sea).

The chronological succession of the sites at Bandoia B and Mangulane Kilns is as follows :

(*a*) Middle or Upper Oldowan industries during beginning of second advance of the sea (Period III A).
(*b*) Abbevillian industries during beginning and middle of second advance of the sea (Period III A to III B).
(*c*) Erosion of sandstone on road between trading store and quarry towards end of second advance (Period III B to III C).
(*d*) Acheulean industries during end of second advance of the sea (Period III C).
(*e*) Calcification of limestone terraces during second advance (Period IV).
(*f*) Formation of 15 to 20 metres terrace at Bandoia B, during third advance (Period V).
(*g*) Middle Palaeolithic (Lusitanian type) industries (Period V to VI).

(C) Posto Velho da Moamba

The railway line from Moamba to Magude passes through a cutting at kilometre 59 about 3 km. from Posto Velho, exposing a bed of rolled pebbles which contains implements of the Lower Palaeolithic. The implements collected by Prof. Abbé Breuil, Prof. van Riet Lowe and Engenherio Borges were found in beds similar to the ones from which mine were obtained (in the report of this visit, it cames under the heading of Antigo Posto).

The locality is nearly 50 kilometres from the present shore line and 120 metres above sea level, 35 metres above the normal flood plain of the Incomati, *i.e.* it is at a higher elevation than the actual site of Posto and Moamba.

A cross section through this locality shows a sandstone of weak structure consisting of fine sands, on top of which lies an alluvial bed 4 metres thick consisting of rough material with rolled pebbles of different sizes. Above this, at the surface of the land, there is about 60 centimetres of ordinary soil horizons. The black soil contains small pebbles.

Characteristic of the upper of these beds are rolled pebbles of quartzite and other rocks typical of the Incomati alluvial deposits. The lower bed is composed exclusively of fragments of basalt, which forms the bed rock at Moamba. I do not think that either of these beds is of fluviatile origin. The upper bed contains flakes and small implements belonging to the Middle or Upper Palaeolithic which, together with other more ancient implements, rolled and unrolled, form what I have called the *Palaeolithic Complex of the Sabie.*

The underlying bed contains pre-Abbevillian implements, classified as such by Prof. Abbé Breuil and Prof. van Riet Lowe, which are in such a rolled condition that they are almost unrecognisable.

It is presumed that the layers of sandstone and rolled pebbles, which constitute the raised beach, must belong to the Lower Pleistocene, (first advance of the sea, Period I). The sea covered Mangulane at 88 metres above its present level and on its retreat it eroded Magude at 56 metres. Therefore, a sea at 120 metres must be older than this and must belong to the beginning of the Quaternary. On the other hand, the doubtful implements being extremely rolled are likely to be contemporary with, if not older than, the formation of the beach.

Chronology of the Quaternary According to Regional Data

From the study of the geological and archaeological data at these three sites, a chronology of the Quaternary may be attempted as regards the main periods. Thus we have :

(*a*) A wet period during a marine advance in which the sea reached 120 metres (Period I).

(*b*) A badly defined period, during the process of retreat, probably dry (Period II).

(*c*) A long wet period corresponding to a sea advance (90 metres) during which the formation of the main river deposits took place. This period is divided into several sub-periods (Period III).

(*d*) A long dry period corresponding to a retreat of the sea with the drying up of big areas (Guija clays) and the accumulation of many red sand dunes (Period IV).

(*e*) A wet period corresponding to advance of the sea up to the 25 metre level (Period V).

(*f*) A dry period corresponding to a retreat, with formation of sand dunes (Period VI).

(*g*) A wet period of marine advance, perhaps 12 metres high, badly defined, with formation of fluviatile terraces (Period VII).

(*h*) A drier period than the previous one with which it may be almost contemporary. The level of the sea fluctuated within a range of 2 metres (Period VIII).

A Classification of Palaeolithic Industries

The following industries may be distinguished within the period with which we are concerned :

1. A very doubtful flake industry during the first sea advance.

2. A Lower Oldowan industry of very bulky handaxes with short butts, perhaps cores, and corresponding flakes, during the end of the first sea advance, first retreat, and beginning of the second sea advance.

3. An upper Oldowan industry comprising handaxes with short butts, medium sized, during the beginning and middle of the second advance.

4. An industry of bulky, rough amigdaloidal hand-axes during the early phase and middle of the second advance (Lower Abbevillian mixed with Clactonian).

5. An upper Abbevillian industry mixed with Clactonian consisting of smaller and more perfect amigdaloids and cleavers, during the middle of the second transgression.

6. An industry of amigdaloids and cleavers derived from flakes towards the end of the second advance (Lower Acheulean with Clactonian).

7. An Upper Acheulean industry of amigdaloids and cleavers derived from flakes, well shaped and finished, towards the end of the second advance.

TABLE I. CHRONOLOGY OF THE PLEISTOCENE
According to Geo-Archaeological data from several of the Incomati sites (tentative classification)

	Periods		*Posto Velho da Moamba*	*Marijaringa*	*Magude*	*Palaeolithic Industries*
Holocene	4th retreat	VIII				
	4th advance or 4th pluvial period	VII				Paleolithic Complex of the Sabie
Upper Pleistocene	3rd retreat or interpluvial	VI				
	3rd advance or 3rd pluvial period	V		Formation of 15–20 metres Fluviatile Terraces	Formation of yellowish layer by infiltration of fine particles carried by rainwater	
Middle Pleistocene	2nd retreat or 2nd interpluvial	IV		Accumulation of red sands and calcification of beds	Accumulation of red sands	Lower Fauresmith
	2nd advance or 2nd pluvial period	*c* III *b* *a*		Last erosion of the sandstone (70 metres) Formation of the layer of pebbles at Mangulane	Last erosion of the sandstone	Upper Acheullan Lower Acheulean Clactonian Upper Abbevillian Clactonian Upper Oldowan Lower Abbevillian Clactonian Lower Oldowan
Lower Pleistocene	1st retreat or 1st interpluvial	II	Erosion of the 95 metres Terraces			
	1st advance or 1st pluvial period	I	Formation of the Upper bed (quartzite) Formation of the Lower bed (basalt pebbles) Formation of quartzite terraces at heights above 120 metres			Doubtful implements

TABLE II.

LEVELS OF THE PALEOLITHIC SITES

Above sea level *Meters*	*Posto Velho da Moamba*		*Marijaringa*		*Magude*		*Above sea level* *Feet*
	Above normal flood plane meters	*Formations and their localisations*	*Above normal flood plane meters*	*Formations and their localisations*	*Above normal flood plane meters*	*Formations and their localisations*	
120	38	With quartzite pebbles		Sea of	the 1st	advance	400
	34	Basalt pebbles					
110	24	Moamba					350
	21	Posto Velho					
100			38				
				Red Sands			
			30	Sea of	the 2nd	advance	300
90			27	Pebbles			
	0	Incomati plains					

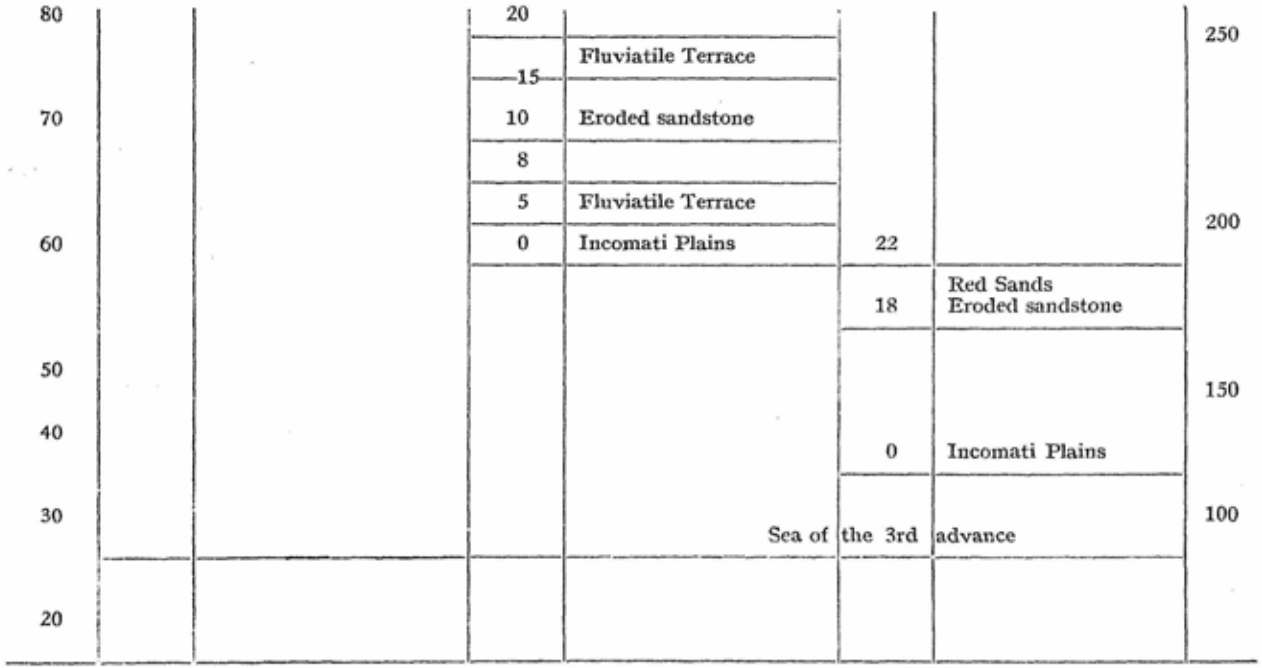
80
70
60
50
40
30
20
20
Fluviatile Terrace
15
10
Eroded sandstone
8
5
Fluviatile Terrace
0
Incomati Plains
22
18
Red Sands
Eroded sandstone
0
Incomati Plains
Sea of the 3rd advance
250
200
150
100

TABLE III.

TENTATIVE CHRONOLOGICAL CORRELATION BETWEEN SOUTH AFRICA AND EUROPE

Great Divisions of the Quaternary	*Period*	Geology					Pre-history	
		Southern Africa			*Europe*		*Southern Africa*	*Europe*
		Eustatic Movements	*Climates*	*Formations in South Africa*	*Eustatic Movements*	*Glaciation*	*Sul do Save*	
Holocene	VIII	4th retreat	Semi arid		Flandrian	III Würm II		Upper Palaeolithic Levalloisian IV, V, VI, VII Acheulean VI, VII
	VII	4th advance	Pluvial	Schalplatz		I	Palaeolithic	
Upper Pleistocene	VI	3rd retreat	Semi arid		Grimaldian		Complex of the Sabie	Levalloisian III Acheulean V
	V	3rd advance	Pluvial	Youngest Gravels		Riss II I		Levalloisian II Acheulean IV
Middle Pleistocene	IV *c*	2nd retreat	Semi arid		Tyrrhenian		Fauresmith Upper Acheulean	Levalloisian I Acheulean III
	III *b*	2nd advance	Intermittently pluvial	Younger Gravels		Mindel II	Lower Acheulean Upper Abbevillian	Acheulean II
	a					I	Lower Abbevillian Oldowan	Clactonian II Acheulean I
Lower Pleistocene	II	1st retreat	Semi arid		Millazzian			Clactonian I
	I	1st advance	Pluvial	Older Gravels		Gunz		Abbevillian

8. Several industries, including some of the implements mentioned above but of smaller size (perhaps Middle Stone Age) during the second retreat.

9. An assemblage of several industries amongst which the Lusitaniense and the Pietersburg are found. They have not been studied in detail and are referred to in this paper under the heading of *Palaeolithic Complex of the Sabie*.

Both the geological data and industries in the areas considered above agree with South African classifications, although the circumstances under which they developed were quite different. In South Africa wet periods gave rise to Quaternary terraces, with dry intervals corresponding to areas of calcified, silicified, lateritic or aeolian deposits. In the area described we have to take into consideration not only continental factors, but also eustatic movements, which gave rise to the immersion of extensive land areas, affected the heights of river beds and left traces of marine erosion on the harder rocks. Besides this, the effect of dry winds which led to the accumulation of sand dunes has to be taken into consideration. Table III gives in broad outline a possible correlation between this area, South Africa and Europe.

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THE FINAL PHASE OF THE MIDDLE STONE AGE IN SOUTH AFRICA

B. D. Malan

In South Africa three main divisions in the Stone Age are recognised : the Earlier, Middle and Later Stone Age. These may be compared broadly with the Lower, Middle and Upper Palaeolithic of Europe, but such comparisons must rest for the present on purely typological considerations, and differences demand as much attention as do points of identity.

There is no more difficult and complicated period in the prehistory of South Africa than the Middle Stone Age. Goodwin (1928) was the first to establish the term in our literature, though he has given the credit for its conception to Neville Jones (1935), and it received recognition at the conference in Pretoria at which the basis of the terminology now in general use in South Africa was adopted.

This Middle Stone Age period saw the appearance and development of a large number of local cultures, the inter-relationships of which are not yet known. The most important feature common to all Middle Stone Age cultures is the employemnt of a technique identical with that of the Upper Levallois of Europe, characterised by a variety of forms of cores and the careful preparation of striking platforms. It must be emphasized that in South Africa the term Levallois is used solely to denote a *technique*, without implying any other relationship with the Levallois of Europe. As yet we have no reliable stratigraphical evidence to establish the sequence of these cultures and variations *within* the Middle Stone Age, and have perforce for the present to rely on typology alone to a great extent. On such rather inadequate grounds we may for the moment consider the Glen Gray and Hagenstad variations as early representatives of the Middle Stone Age, while the Stillbay, Mossel Bay, Pietersburg and Mazelspoort Cultures may be regarded as mid to later expressions of the Middle Stone Age. To this group should be added the Rhodesian Stillbay material from Bambata in Southern Rhodesia and the material from Natal which strongly resembles the Stillbay but might be somewhat more advanced (Malan, 1944). The Howieson's Poort variation is still rather a problem. It was at first considered to be a temporary stage of development within the Stillbay, and was reported to occur in the Skildergat Cave, Fish Hoek, inter-stratified between Stillbay deposits (Goodwin 1933). Recent re-examination of the field notes

of the excavators, the late V. S. and B. Peers, as well as other evidence has led to the tentative conclusion that the Howieson's Poort variation followed after the Stillbay. It will not be surprising if it is found that the Howieson's Poort is the counterpart in the Southern Mountains Region of the Final Pietersburg of the interior.

It was for long thought that the Middle Stone Age with its exclusive application of the Levallois technique came to a more or less abrupt end at a stage of development represented by the Stillbay and Pietersburg Cultures, after which there appeared in South Africa an entirely new group of industries, collectively known under the general term Later Stone Age, in which the Levallois technique had entirely disappeared and been replaced by pure blade and (later) microlithic industries. This marked gap in the natural technical development has long been a source of some dissatisfaction to the writer, for the lack of any bridge between the Middle and Later Stone Age techniques seemed to demand explanation. This uneasiness was intensified by the recognition of the Magosian in Uganda (Burkitt and Wayland 1932) with its combination of Lavallois and Microlithic forms which seemed to provide exactly the link which we required in the Union.

Before the Magosian had been described, Neville Jones (1926) had described the Sawmills Industry which that author and Dr. Leakey subsequently agreed is indistinguishable from the Magosian (1945). This meant that the link we sought had been established in an adjacent territory in which advanced Middle Stone Age on the one hand, and Microlithic industries on the other, each similar to corresponding cultures in the Union, had already been reported.

In 1934 Professor R. A. Dart and a party from the Department of Anatomy, University of the Witwatersrand, conducted preliminary excavations in a cave near the crest of the Lebombo Mountains which form the boundary between Swaziland and Zululand, known as the Border Cave. The work of Professor Dart's party was continued and extended in 1941 and 1942 by two parties led by Dr. H. B. S. Cooke, Dr. L. H. Wells and the writer. No detailed report of this work has yet been published, but a preliminary note appeared in ' Man ' 1943, 3.

The excavations in Border Cave show an unbroken development of the Pietersburg Culture of the Middle Stone Age from a simple early stage with broad flakes derived from cores with prepared striking platforms, though numerous plain striking platforms occur. Secondary trimming is crude, and often entirely absent. Gradual technical progression leads to more advanced

forms with thinner flakes and points, elaborate preparation of striking platforms, more developed secondary trimming and a greater variety of tool forms. After a short interval of less intense habitation of the cave there developed a very refined expression of the same industry which includes slender, ribbon-like blades, numerous backed blades, butt-end scrapers and small pressure-trimmed triangular 'arrow-heads'. This final stage is regarded as a link in the transition from the Levallois technique of the Middle Stone Age to the non-Levallois blade technique of the Later Stone Age, although it is almost purely Levallois in character. It thus seems to form the counterpart in the interior of the Howieson's Poort Variation of the Southern Mountains region, developed from the Pietersburg Culture of the Transvaal in the same way as the Howieson's Poort developed from the Stillbay.

Some further light on the final stages of the Middle Stone Age has been gained from work which I have been able to do in the eastern Orange Free State near the Basutoland boundary. In 1938 Mr. J. W. Eddols, a teacher at Modderpoort, submitted a collection of artefacts to the Union Archaeological Survey which immediately interested me, and in 1941 I published a paper on the 'Middle Stone Age of the Upper Caledon Valley: the Modderpoort Culture' in which Mr. Eddols's collection was described together with the material collected by me from the same site and comparable material from other sites kindly placed at my disposal by Dr. L. H. Wells. I was at that time unable to identify this material with any previously described Culture and proposed for it the new term 'Modderpoort Culture'. I recognized that the character of the Levallois technique displayed by this material was comparable with that of the Magosian, but my collections lacked the non-Levallois microlithic tools which characterise the Magosian. The few microliths which were present in the collection were regarded as intrusive on an open site in an area in which Wilton sites abound.

Subsequent work in a cave known as Rose Cottage Cave, on the commonage of the town of Ladybrand in the Orange Free State provided material which led me to review these conclusions, but it was only after my arrival in Nairobi that I was able to see Magosian material which convinced me that what I had described as the Modderpoort Culture is in fact a South African expression of the Magosian. I therefore propose now to abandon the term of my own invention and to apply the term South African Magosian to this Culture which was not previously known south of the Limpopo river. In the meanwhile the so-called Modderpoort Culture was

found on other sites in the same area, as well as in the vicinity of Kimberley, and its affinities with material underlying the ancient Bantu deposits at Mapungubwe were recognised. These ideas were tentatively put forward in a short paper in 1945.

Rose Cottage Cave is situated near the crest of a cliff of cave sandstone forming part of the Drakensberg foothills, a few miles from the Caledon River which forms the boundary between the Orange Free State and Basutoland. It has been formed by the falling away of a large portion of the cliff which still blocks the cave, so that it is entered only through a narrow passage at the eastern extremity of the large block, or a wider opening at its western end. The cave therefore provided an excellent and easily defensible shelter, its only drawback being that for considerable periods of the year it is not dry. Water enters alongside and over the block in its mouth, and springs along the back wall become active after rains. The presence of these springs and the obstruction provided by the large block are important factors in the stratigraphy of the deposits, for the water washed considerable quantities of sand into the cave at various times, and the block caused their deposition in the cave. The unusual depth of 20 ft. of deposit is in part explained by these natural circumstances which resulted at times in rapid accumulation of sand, so that too great an age must not be ascribed even to the earliest deposits.

These excavations have only recently been completed, and it has not yet been possible to study carefully the material recovered. It was observed however, that the South African Magosian underwent three stages of development and that the general impression of the culture as gained from the type *surface* site requires revision.

The Lower South African Magosian which rests on bed rock in Rose Cottage Cave consists predominantly of very advanced Levallois flakes and blades with carefully prepared striking platforms predominating over other types. Fair average dimensions are length 5 to 8 cm., greatest width 2.5 to 3 c.m, thickness 0.3 to 0.6 cm. Tools are limited in variety and consist mainly of points and side-scrapers. Secondary trimming is of the kind associated with direct freehand percussion and is limited to the edges of the implements. In rare specimens the cleavage faces show secondary trimming, but reduction of bulbs of percussion was not noted. Two groups of material were used : fine-grained sandstones and some indurated shale on the one hand and cherts, chalcedonies and agates from the Drakensberg volcanics on the other. While the technique generally and habitually applied was Levallois, there is

a small proportion of small blades and random fragments in chert and chalcedony which is not Levallois in character and reflects the technique of the microlithic industries of the Later Stone Age.

As the culture developed the smaller, non-Levallois element gained ascendancy, and in the Middle stage of the South African Magosian which overlies the Lower, the non-Levallois element predominates over the Levallois, while cherts, chalcedonies and agates predominate over sandstone. Tools with secondary trimming are not abundant. Those showing the Levallois technique are points and side-scrapers, and do not differ from their counterparts of the Lower Modderpoort. In the non-Levallois element tools are even more rare, but we noted a few simple endscrapers and side-scrapers which suggest a link with the Smithfield and Wilton of the Later Stone Age.

The Upper South African Magosian which in turn lies stratigraphically above the Middle Stage of the culture was comparatively short-lived and saw an intensification of the Levallois technique applied to all materials, and specialisation in points trimmed on one face, with occasional reduction of bulbs of percussion. A feature of this stage is the abundance of twice-worked specimens, and it is clear that a site containing earlier flakes provided a considerable proportion of the raw material. The non-Levallois element is by no means absent, but for some reason took second place to the Levallois for a short time. In this level the proportion of tools to debitage is much higher, and a greater variety of tool types was produced.

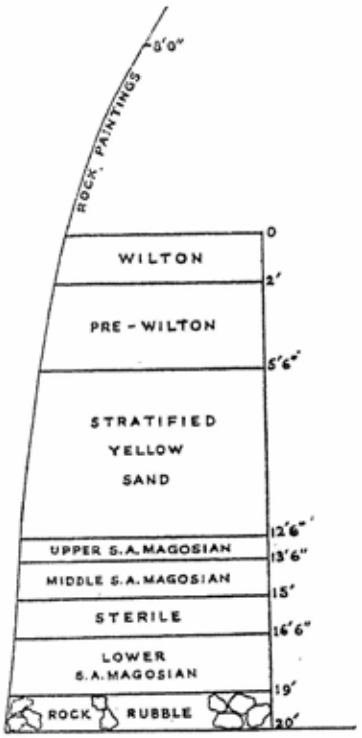
Above the Upper South African Magosian levels there accumulated a thick deposit of fine stratified yellow sand, remarkably free of rock fragments, which apparently washed into the cave from springs which became active near the back wall of the cave and may have rendered the site temporarily unattractive as a habitation. This sand is not entirely sterile, but is unbroken by discernable occupation floors. Sporadic traces of carbon and occasional flakes and fragments are uninformative, but some very small Levallois flakes can only be described as ' microlithic Levallois ' in character.

After the accumulation of this sand the cave was reoccupied, and we find a considerable thickness of grey ashy deposit, extremely rich in debitage of a microlithic industry which it is difficult to analyse by virtue of the almost total absence of recognisable tools. This industry contains no trace of the Levallois technique. Microlithic cores abound, many of them showing bi-polar flaking, *i.e.* direct rest percussion in which the core was held at rest on an

anvil while it was being struck. The most common artefacts, however, are extremely small, slender blades, many of which show some damage along one or both edges on the cleavage faces. Very rare endscrapers such as characterise the microlithic industries of the Later Stone Age in South Africa, however, form a suggestive link in the sequence of development.

Above this rather difficult and anomalous material two stages of a microlithic Wilton culture of the Later Stone Age bring the story of the occupation of the cave to a close. Large collections from numerous surface sites in the same region have led us to the tentative recognition of an Orange Free State Wilton which differs from the Wilton of other regions mainly in the presence of bifaced tanged arrow-heads and the very small size of many of the crescents which are abundant.

Although it is no part of the object of this paper to discuss prehistoric art, it is interesting to note that ochreous pigments were associated with the South African Magosian throughout its three stages in Rose Cottage Cave. The cave walls are adorned with paintings: the highest are eight feet above present floor level, while the lowest appeared to be buried by the deposit. These paintings were clearly out of reach of the highest Modderpoort occupation level which is some eleven feet below the lowest existing paintings. Unfortunately no paintings could be discerned below the present floor level, and it is impossible to say whether the pigments found in the deep levels were used for this purpose, though they certainly were capable of producing the same tints as appear in the existing paintings. While, then, we cannot be certain that the mural art dates back as far as Magosian times, the evidence is at least suggestive and strengthens the Abbé Brueil's surmise that a far greater age should be ascribed to the oldest paintings than has generally been the case in the past.



Rose Cottage Cave, Ladybrand, South Africa.
Diagramatic section of Deposits.

Conclusions

Two interesting conclusions emerge from this recent work. On evidence from Apis Rock, Leakey (1936) supports Wayland's view that the Magosian is derived from the Stillbay Culture, while O'Brien (1939) dissents from this view in holding that the Magosian 'represents a contact, some time during the Makalian period, between a very late stage of Stillbay . . . and an early stage of Wilton, already in existence.' Evidence from the Rose Cottage Cave seems to favour Wayland's and Leakey's view that we are here dealing with a developmental stage bridging the Middle and Later Stone Ages rather than a result of contact between co-existing cultures. The other tentative conclusion to which I am inclined is that we need no longer look to cultural diffusion from the north to account for the appearance of the South African Wilton. There seems to be no reason why the Wilton should not have developed locally from the Middle Stone Age through stages represented by the Final Pietersburg of Border Cave and the Howieson's Poort with a refined Levallois technique, followed by the South African Magosian of Rose Cottage Cave with its combination of Levallois and microlithic techniques.

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SOME ASPECTS OF THE STONE AGE IN THE BELGIAN CONGO

F. Cabu

Until recently the Prehistory of the Belgian Congo was very imperfectly known. Menghin's first description of the ill-named Tumbian in 1925 is very misleading and in 1936 at the International Congress of Anthropology held in Brussels, a resolution was passed favouring the adoption of the terms Kalinian and Djokocian in place of the Tumbian. Menghin's material comprised only surface finds, but an industry with similar tools, at least in the early stages, was described as the Sangoan from Uganda by Wayland in 1923 and this material was found *in situ*.

During the war, specimens from the Congo were shown to van Riet Lowe, Goodwin and the Abbé Breuil in South Africa and they too used the terms Kalinian and Djokocian in place of the Tumbian. These are, however, by no means the only industries known from the Belgian Congo. In describing the Prehistory of the Colony, the southern area will be divided into three regions :

A. The basin of the Upper Congo River.

B. The basin of the Kasai River.

C. The south western Congo.

1. Pebble Cultures

A. In deposits covering the end-Tertiary peneplane in the Upper Congo basin and in fluviatile deposits of the river system that drained it, a Pebble Culture has been found. The type site is situated on the road from Elisabethville to Kasenga at the 81 km. post in the Kafila valley, under the laterised terraces. Mortelmans gave the name of Kafilian to this industry, which he found *in situ*. It resembles the Kafuan of Uganda and Kenya and this industry is again represented at a slightly lower level on the eastern slope of the Mulundwe valley, a tributary of the Kafila.

The pebble tools of the Kafilian are of larger size than the Kafuan and may be divided into five stages according to the patina. Other pebble tools worked on both sides represent a transition to the Oldowan of Tanganyika. The pebbles have been flaked according to the Clacton, Tayacian and bipolar techniques.

Some 600 kilometres from Kafila, at Kamina, Belgian Congo Oldowan with alternate flaking has also been found. Between Kafila and Kamina, at Mutumba mountain, gravels eroded by wind

or water contain both Kafuan and Oldowan forms. The Abbé Breuil compares these with the 90–100 metres raised beach at Casablanca and with the older gravels of the Vaal river, earlier than those containing Stellenbosch I.

The entrenching of the Kafila and its filling and capping with laterised soil gives evidence of the climatic variations which took place at the time of the Pebble Cultures. In Mortelmans' opinion, the river systems of the Lower Pleistocene were generally formed in channels or synclinal troughs of the Tertiary penepelane, with a general south-north direction. When the Upemba *graben* sank, much river capture and reversed drainage took place in the Katanga. Faulting seems to have been more severe in Central than in Eastern Africa.

B. Pebble cultures in the Kasai basin have not yet been found *in situ*, but tools have been recovered from gravel deposits or on the surface. Janmart, over the Belgian Congo border in Angola, has made important discoveries at Candombe on the 20 m. terrace of the Luembe River. Here there is *in situ* a waterworn Oldowan culture, called by him the Lunda Oldowan.

C. Pebble cultures in the south western Congo have not yet been discovered *in situ*.

2. Abbevillo-Acheulian (Stellenbosch) Cultures

A. At Kamoa artefacts of the great Hand-axe Culture have been found, and typologically they may be divided into three, possibly four, series. The oldest is a roughly flaked Abbevillian comparable with Stellenbosch I of the 50 ft. terrace at Vereeniging and with the Clacto-Abbevillian of the Sicilian beach at Casablanca.

The second series contains oval hand-axes and cleavers and flakes of Proto-Levallois type (Victoria West technique). They are the counterpart of Stellenbosch material from the Vaal Younger Gravels. The cleavers showing parallelogramatic section are identical to the Stellenbosch III cleavers of the Vaal and those of the 'M' horizon of Uganda.

The third series consists of little worn bi- and unifaces, carefully made, which the Abbé Breuil compares with the Stellenbosch IV and V of the Vaal, the Acheulean superimposed on the Tyrrhenian beach of El Hank at Casablanca, and perhaps the French Acheulean IV and V.

I believe that Victoria West (proto-Levallois) flakes are there also. Jamotte has recognised Clacto-Tayacian and Tayacian flakes in the Luapula cliff at Kusengo and Mortelmans has found Clacto-

Tayacian and Tayacian flakes in the old deposits of the Luabo river. In the 45 metre terrace of the Luvua Murika river, Mortelmans also found a Clacto-Acheulean industry similar to Stellenbosch II. At the foot of Mount Kisanga, near Elisabethville, Mortelmans and Jamotte found rolled Stellenbosch I and fresh Stellenbosch II.

The terms Belgian Congo Stellenbosch I, II, III and so on would be acceptible for these industries, or alternatively Belgian Congo Acheulian I–IV.

The Kalinian or Acheulo-Levalloisian industries, or the Belgian Congo Fauresmith, exists in some parts of the Katanga—the Lovoi, Kilubi and Kalumbay river terraces—and must be correlated with the Luangwa river terraces in Northern Rhodesia. This industry is better known from the next region, the Kasai basin.

B. The great Hand-axe Culture has not yet been discovered *in situ* in the Kasai country, though implements of this type exist rolled in the gravels of the 30 m. terraces.

The Kalinian, or Sangoan Fauresmith, is better known from this part of the country. A peculiar facies detached itself from the Middle Stellenbosch and finds its more perfect expression in the Acheulo-Levalloisian Kalinian industry.

The proto-Kalinian consists of heavy *bifaces* with cortex over an unworked butt, while the working edge is carefully worked over both faces. This industry has only been found in a rolled state, either on slopes or in Kalinian terraces.

The Kalinian proper may be dated to the final semi arid phase of the Middle Pleistocene and beginning of the Gamblian pluvial. The technique is of evolved Levallois type, with picks, chisels, gouges and various bi-facetted tools on cores or on flakes—sometimes on diminutive Victoria West flakes. The *bifaces* show triangular or biconvex section. They can be compared with small lance-shaped Micoquian *bifaces*, Mousteroid points and leaf-shaped *bifaces*. Tortoise cores, flakes with facetted butts and crude blades complete the assemblage

The Kalinian consists of the first stage of the previously-named Tumbian. Van Riet Lowe drew attention to similarities between some Fauresmith types and some from the Congo 'Tumbian' (S.A. Journ. Sci. Nov. 1935). The Kalinian and the Fauresmith appear to be two facies of the same culture and are the counterpart of the Mousterian-with-*bifaces* of Europe.

The most important Kalinian sites in the Kasai district are in a terrace 30 metres above the present day river: the top of the

sediments reach 60–90 metres higher *i.e.* at 800 m. above sea level. This is known as the High Terrace. The cross-section is from top to bottom :

(*d*) Red aeolian sand.
(*c*) Heavy layer of red clays, unstratified, of aeolian origin, often topped by laterite.
(*b*) River sands and clays, greyish.
(*a*) Basal gravels with boulders.

In the bottom layer (*a*), waterworn Kalinian implements occur : oval *bifaces*, thick chisels and gouges. In the second layer (*b*) together with these tools, there occur for the first time pointed weapons, lance shaped *bifaces* of Micoquian form, large Acheuloid *bifaces* and thick laurel-leaf forms, all types that are found in the Vaal Fauresmith. In layer (*c*) there is an important change : as well as the Kalinian forms which are still present, there are also long pointed weapons. The final Kalinian, contemporary with the Kamasio-Gamblian phase, leads to the Djokocian.

The Djokocian industry is found in the upper part of the Lower Terrace, whose top lies 100 m. below the top of the Kalinian Terrace. The base of the terrace is composed of large pebbles, topped by river sands above reddish clayey sand.

In the gravels a water-worn series is found, derived from the higher levels. On the surface of this layer, at the base of the sands, pointed daggers are found. Bifaced work continues the Kalinian technique, but with pressure flaking. The leaf-shaped implements are reminiscent of the Solutrean or the South African Proto-Stillbay.

In the sands are found neat blades, two or three sided, comparable with those of the Upper Palaeolithic of Europe. The Chatelperron blade appears for the first time. The daggers have developed into assegais and are much smaller. Other points are now as small as arrow points. Solutreoid laurel-leaves, both large and as small as arrow heads, complete this assemblage which has a Stillbay flavour. This stage of the Djokocian was named Lupembian by Abbé Breuil.

A still more evolved stage, known as the Tshitolian, is found far from the Kasai river in surface deposits on the plateau of the Bene Bhitolo, near Bibange. It occurs on red sand mixed with humus, with laterite at its base. This stage seems to correspond to a final Middle Stone Age, similar to that of Howieson's Poort of the Cape and to the Upper Solutrean of Parpallo-Alicante, Spain.

At this stage the use of blades is generalised and the scraper and Chatelperron points become common. Leaf-shaped tanged

points and embryonic barbs are seen for the first time. The bow now replaces manual projection and the arrow replaces the assegai. Mr. Pierre Stalon has made similar finds in the Kasai country.

C. In south western Congo, the same state of affairs exists. In the 15 m. terrace of Leopoldville the succession is as follows :

(*a*) Subangular basal gravels and boulders, interstratified with grey sand. Archaic industries : Abbevillean or Stellenbosch rare.

(*b*) Grey sand on the eastern bank of the channel. A crude industry comparable with Stellenbosch II.

(*c*) Kaolinaceous sand on the western bank. Evolved Acheulean, similar to Stellenbosch II and III, together with proto-Kalinian forms.

(*d*) Lower Kalinian on the surface of the kaolinaceous sand.

(*e*) At the base of red clay with nodules, oval spool-shaped picks akin to the evolved Kalinian of the Kasai.

In the 9–11 metre terrace, in the channel cutting the 15 m. terrace, two Kalinian series are found in a peat and sandstone layer, one rolled and the other fresh. They are overlain by white sands containing picks, chisels and leaf-shaped points : probably an evolution towards the Djokocian, but lacking the beautiful daggers.

The same terrace near the Congo river at Kalina was described by Colette. He found clay and boulders with Stellenbosch, proto-Kalinian and Kalinian forms, overlain by gravel containing an evolved Kalinian industry. Above them came brown clays containing Djokocian, with silts and humus at the top, and two levels of triangular axes with a slightly circular cutting edge, little polished, as well as arrowheads. This stage represents the Leopoldville Neolithic. In the other level were picks, *tranchets*, blades and arrow heads of reduced size (Ndolian Mesolithic). These two levels together are the equivalent of Vaufrey's Mesolithic of Guinea.

On the 5 metre terrace in the Leopoldville country, the Rev. Brother H. Moortsel has found the following succession :

(*a*) barren sands.

(*b*) spotted river clays with evolved Djokocian, possibly Lupembian

(*c*) brown clay with evolved Tshitolian

(*d*) humus and pottery.

In sandy and clayey earths overlying the polymorphic sandstone of the Miocene peneplane in the Thysville hills, Jamotte and Cohen found evolved Kalinian.

The Tshitolian (or uppermost development of the Djokocian)

is by no means the last of the Congo industries. P. van den Brande found a Kasiki Magosian industry in clay under humus in the hills of the western side of Lake Tanganyika, where he also found rock paintings. There are also rock paintings in the Lubundi country on the banks of the Upper Congo.

Numerous bored stones occur in the east of the Colony, bordering Uganda, and again in the north on the borders of Sudan. In the south, the Congo Zambesi country has yielded polished axes, which are also found in the Ituri on the Sudan border and again near the Uele and Ubangi rivers on the border of French Equatorial Africa.

Conclusions

Conclusions, based on Mortelmans' paper read at the Geological Congress in Brussels, may be summarised as follows :

I. Quaternary times were preceded, in the whole Southern Congo basin, by the formation of two peneplanes : the older is of Miocene age and the younger, 2–300 m. below, is the end-Tertiary peneplane.

II. During the Lower Pleistocene occurred the Kageran (Kafuan) pluvial, which created the main features of the present hydrographic system. It is associated with a Pebble Culture.

III. At the end of the Lower Pleistocene came a dry phase, with silting up of the valleys by aeolian re-distribution of the Kalahari sand, and associated tectonic movements. The Hand-axe Culture is represented by Clacto-Abbevillian or Stellenbosch I forms.

IV. During the Middle Pleistocene came the Kamasian pluvial, with marked oscillations. River terraces contain, together with the great Hand-axe Culture (Stellenbosch-Kamoa), industries based on the Clactonian and proto-Levallois, Tayacian and Tayaco-Levalloisian techniques. These are well developed in Katanga. Also a proto-Kalinian (Sangoan) facies appears, evolving towards the Kalinian. During the arid phase following this pluvial period, new tectonic movements took place, which synchronise with those in East Africa which affected the Fauresmith levels on the Kinangop. These movements are less marked in the Congo, but were sufficient to cause a sinking of about 100 metres in Katanga and the Lower Congo.

V. At the very end of the Middle Pleistocene and during the Upper Pleistocene, came a pluvial period which can be equated

to the Gamblian of East Africa. At this time the Kalinian industries gave way to those of the Middle Stone Age ; (*a*) the Katanga complex with flake techniques predominant (Sofwian, Lunkolian and Stillbay industries) ; (*b*) the Kasai and western Congo complex with *bifaces* (Djokocian, Lupembian, Tshitolian).

The end of this period (Upper Pleistocene) was very arid, especially in Katanga and the Leopoldville area. Locally, a last peneplane is formed.

VI. The extreme end of the Upper Pleistocene and the Holocene shows rejuvination of the rivers. During the last wet period (Sofwe section), industries pass from the Katanga M.S.A., through the Kasikian, to the L.S.A. with microliths and so to Mesolithic and Neolithic industries. In Leopoldville, the Tshitolian gives birth to a Mesolithic of peculiar form.

THE TUMBIAN CULTURE IN EAST AFRICA

L. S. B. Leakey

As a result of the detailed work carried out by the late Archdeacon Owen in the Nyanza Province of Kenya, work which supplemented that done earlier by Mr. O'Brien in Uganda, it became clear that there were a number of evolutionary stages of the culture commonly known as ' Tumbian '.

The results of Owen's work have been published in the joint paper by L. S. B. Leakey and W. E. Owen and need not be discussed in detail. It is clear that this culture can be traced backwards to the culture which Wayland called ' Sangoan ' in Uganda and that most of its stages belong in time to the Upper Pleistocene, although it may have its roots in the Middle Pleistocene. Certain late stages are post-Pleistocene in date.

The use of, or rather the retention of, the term ' Tumbian ' as a name for this culture has been widely criticised because of the fact that this name was originally applied by O. Menghin to an assemblage of artifacts containing the most wide and varied assortment of implements of several different ages.

In the Congo and elsewhere, following upon the work of Jean Colette and Cabu, it has become usual to abandon the term ' Tumbian ' in favour of a number of different names, which I feel are, in fact, nothing more than the several stages of a single and individual culture. Such action is comparable to giving different

cultural names to the various minor stages of the Acheulean Culture, which would undoubtedly be very confusing.

If in fact a majority of the workers in Africa feel that the term ' Tumbian ' should be abandoned, then I would not insist upon its retention, although I still feel strongly that, at least as far as the workers trained in Great Britain are concerned, the old term ' Tumbian ' very clearly conjures up the essential elements of the culture, namely, the long bi-facial lanceheads and the typical thick-set picks.

If it is decided that the name ' Tumbian ' is to be abandoned, it is suggested that Wayland's term ' Sangoan ' should be adopted with suitable adjectives to describe the different evolutionary stages of what Leakey and Owen have described as ' Lower and Middle Tumbian '.

So far as the latter post-Pleistocene stages are concerned, it is possible that what Leakey and Owen have called the ' Upper Tumbian ' (which may prove capable of sub-division) is sufficiently distinctive to justify the use of a separate cultural name and it is suggested that the Congo name of ' Lupenban ' should be used as the cultural term for these later stages with, of course, suitable definitive adjectives where necessary.

Saturday, January 18th

NEW LIGHT ON THE UPPER PALAEOLITHIC OF EGYPT

S. A. Huzayyin

It is now becoming more and more evident that the Upper Palaeolithic represented a phase of regional specialization of cultures. In spite of its central geographical situation, Egypt has developed and retained its own facies in the Upper Palaeolithic. Perhaps the most interesting feature in the Upper Palaeolithic of Egypt is that it developed directly from the Levalloisian of the Middle Palaeolithic and received hardly any influences from outside N.E. Africa. This is fully corroborated by discoveries of recent years.

In 1940 Fl.-Lt. R. Grace discovered an implementiferous bed in gravel spread or wash close to the Abu Suwair Air Force Station on the E. border of the Delta. The site lies on the northern

border of Wadi Tumilat, at 15 m. above sea level, or some 9 m. above alluvium in the opposite part of the Delta. A cut was made for an old road which exposed the beds; and artefacts were found in a layer about 30–50 cm. thick at a depth of some 15–20 cm. from the surface. Nearly four thousand specimens (artefacts and chips) have been collected. Though it included only a limited number of finished tools, the collection represented a well defined industry, whose derivation from a Levalloisian or Diminutive Levalloisian facies is beyond question. Cores and core-tools or tool-cores present a distinguishing aspect of the industry. Triangular cores with pointed tips and known in the Levalloisian of Egypt continue, and some of them may well have been intended as core-points. Double-ended cores (*à deux talons*) are well represented, and so are discoidal ones. Other cores are so prepared as to suggest possible use as sling-stones. In addition, a certain number of cores show microlithic features, while a few remind us of axe or chopper tendencies. Cores of this industry, however, do not seem to have been prepared for use as scrapers (such as hoof-shaped scrapers known in the Upper Palaeolithic of Palestine). As to flakes, the industry is poor compared with flake and blade facies of the Upper Palaeolithic in general. They are mostly ordinary simple flakes with prepared or simple-facetted platforms, and very little or no lateral retouch. Where it does occur, the secondary trimming is of the steep type and is applied on the dorsal face of the flake or blade, except very rarely when there is inverse trimming (applied on the ventral smooth face of the flake). A good many of the flakes have still the original cortex on one of the edges. Some are of the so-called 'plunging' type, *i.e.* they plunged through the core when struck, and the ends remote from the bulb are thick and broad and retain scars of the preparation flaking applied on the original core. We may further note that broad flakes predominate over narrow blades; but that the proportion of these latter at Abu Suwair and in N. Egypt in general is higher than we find in the Sabylian of S. Egypt. A few specimens have notches with relatively neat trimming, but the industry is lacking in burins, and only one specimen of a small burin was found. One small hammer-stone was also discovered. Taken as a whole, therefore, the industry represents a distinct facies different from the usual Upper Palaeolithic technique of the Aurignacian in Palestine or the Capsian and Atirian in N.W. Africa, and even showing some differentiation from the Sabylian of S. Egypt, which is more specialised and even more progressive in some respects (such as lateral retouch and trimming).

In 1941 and 1942 Fl.-Lt. R. Grace was transferred to Heliopolis aerodrome and there he discovered in a pit which was being dug for a gun a similar bed with Upper Palaeolithic artefacts. The pit revealed a gravel spread or wash brought during some pluvial, or semipluvial, phase by torrents washing the surface in the direction of the Nile Valley. The tools lay at some 15–20 cm. from surface and occurred in a bed 30 cm. thick. Similar tools and artefacts were also found by Grace and Huzayyin in 1942 in the top layer of the old Abbasyyah Gravel Pits at Cairo. The facies at Heliopolis and Abbasyyah, however, is somewhat different from that of Abu Suwair. The core and tool-core variety is less predominant, and microlithic tendencies are less clear, though this may have been partly due to the fact that original pebbles from which artefacts were made were larger than at Abu-Suwair. But we may especially note here the occurrence of bifacial axes which remind us, typologically, of similar tools of Neolithic and later times. Curiously enough, there is also a number of so-called re-edging flakes, *i.e.* flakes struck off transversly along working edges of axes in order to render these latter sharper and less liable to blunting. Similar re-edging flakes are known (almost solely) from Egypt and during much later times (*i.e.* Predynastic). Could some types of this industry represent, in a way, the precursor of similar Neolithic and post-Neolithic types in flint industries of Egypt? Or was it just recurring chance that led to the appearance of such artefacts as axes and re-edging flakes at two separate stages?

These new discoveries from N. Egypt add new evidence to the theory that Egypt developed its own Upper Palaeolithic facies from the Levalloisian and Diminutive Levalloisian facies of the late Middle Palaeolithic. As revealed by these and other discoveries, the Upper Palaeolithic of N. Egypt, however, represents an unspecialized and seemingly undeveloped facies, with a poorer variety of tools than is known from the Upper Palaeolithic of a neighbouring country such as Palestine. Are we to consider this non-specialization of tools as a sign of an undeveloped technique? Or are we to apply in technology the principle of biologists; namely that 'specialization' is usually a step towards ultimate decay? However this may be, we seem to have in the Upper Palaeolithic of N. Egypt the signs of two lines of development: on the one hand there is the tendency towards a microlithic (Final Palaeolithic) development, and on the other there are artefacts which may ultimately prove to be the precursors of axes and similar implements of the Neolithic and later industries.

CAPSIAN OR AURIGNACIAN? WHICH TERM SHOULD BE USED IN AFRICA?

L. S. B. Leakey

In 1929, when a type series of the implements discovered in the lower levels of Gamble's Cave at Elmenteita were exhibited and discussed at the meeting of the British Association in Johannesburg, it was suggested by Prof. l'Abbé Breuil and others that they represented a typical Aurignacian assemblage comparable to the classic Lower Aurignacian of Europe. The name 'Kenya Aurignacian' was subsequently adopted with suitable definitive terms to indicate various stages.

It has become increasingly clear since 1929 that nowhere in Africa does the true Aurignacian of Aurignac—*i.e.* Middle Aurignacian—occur, and the question arises as to whether it is either wise or suitable to retain the term Aurignacian in describing the blade and burin culture of East Africa.

Up to now I have strenuously opposed the introduction of the term 'Capsian' into our terminology because I felt that in North Africa this term was applied to cultural elements, many of which were later in the time sequence than the Upper Palaeolithic, and, in fact, the term was being used to describe a culture in which microlithic elements were completely dominant.

In East Africa, the culture hitherto described as 'Aurignacian' is essentially an Upper Palaeolithic blade and burin culture although, even in its earliest known stages, a smaller proportion of the implements are of microlithic size with a crescentic form dominant. As the culture developed through its successive stages, these microlithic elements became more numerous.

While it is clear that some name must be sought in substitution for the term 'Aurignacian', unless it be clearly stated that the term is only used as a means of comparison with the Lower Aurignacian, I am not at all certain in my own mind that the term 'Capsian' will be a suitable alternative, and the object of this paper is to seek the advice of my fellow scientists. The views of Congress, and especially of those members who come from North Africa will be welcomed, and I hope that a definite decision will be reached by the Sub-Committee on nomenclature. In view of a communication before this Congress by Dr. Ruhlmann in which he has indicated that a true Capsian culture, with good stratigraphical evolutionary evidence, has been found in cave deposits in North Africa, I feel

that, possibly, there is a balance of evidence in favour of adopting the term ' Capsian ' for our East African blade and burin culture.

It is true that between Kenya and the North African area there is an immense gap in which no similar cultural material has been found, but I believe it probable that this gap will be filled, and in a not too distant future. It was, after all, only recently that a similar gap in the distribution of the hand-axe Culture was filled by discoveries in the Sudan.

NEW DISCOVERIES OF STONE AGE SITES IN ANGOLA

F. Mouta

Apart from recent work done in the diamond area of Lunda by M. Janmart, very little has been published on Stone Age sites in Angola since 1934, when a paper appeared on material collected from the interior of the district of Malange (Nzongolo). The following description concerns the more recent discoveries in the Colony.

I. The Mavoio Region (Congo)

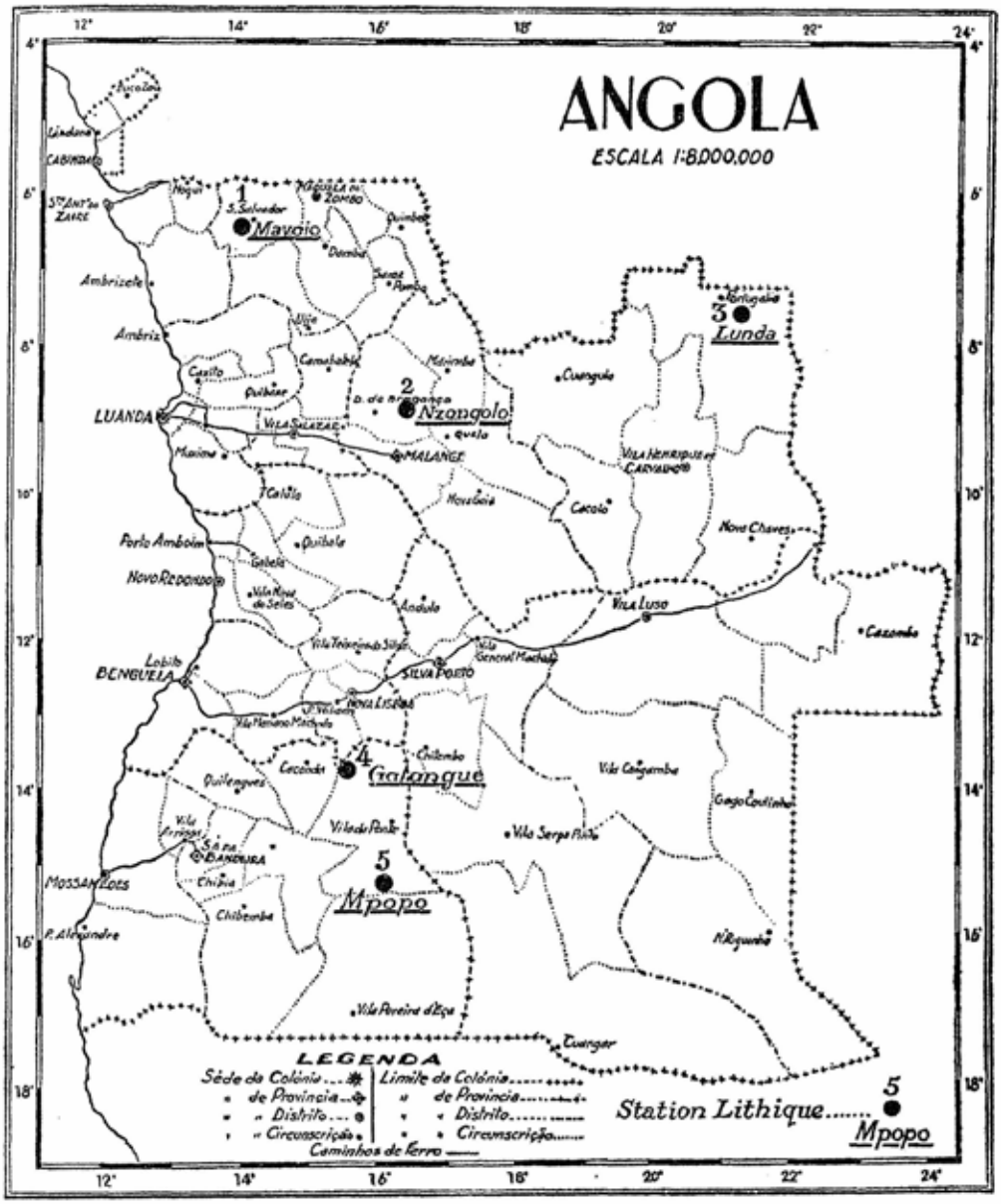
In 1944 H. Vieira collected, from the sides of the Mavoio river, various crude implements and flakes on the surface. This year the '*Empreza de Cobre de Angola*' Company offered a new series of implements to the '*Services de Geologia e Minas*' collected by their geologist Mr. Marrack.

(A) H. Vieira's Collection

The majority of specimens in this collection come from doubtful localities and consist of crudely worked hand-axes, scrapers and points. The hand-axes were made of rounded pebbles, whose original surface is preserved on one side. One single point of transparent quartz shows more delicate retouch and finer workmanship than the others. The material used for the other implements is either fine quartzite or milky or transparent quartz.

(B) L'Empreza de Cobre de Angola Collection

These specimens were also collected in the Mavoio region, from the highest parts of the valleys of the rivers Mavoio-Baué, Quipemba, Lucossa, Lumueje and other tributaries of the Lufunde du Zombo. They were found on the surface of terrace deposits, together with flakes and rolled pebbles. Their abundance in the


ANGOLA
ESCALA 1:8.000.000
1 Mavoio
2 Nzongolo
3 Lunda
4 Galangue
5 Mpopo
LUANDA
BENGUELA
Lobito
NOVO REDONDO
PORTO AMBOIM
SILVA PORTO
VILA LUSO
MALANGE
VILA SALAZAR
VILA HENRIQUE DE CARVALHO
NOVA LISBOA
SA DA BANDEIRA
MOSSAMEDES
P. ALEXANDRE
Station Lithique..... 5 Mpopo
LEGENDA
Séde da Colónia
Limite da Colónia
de Provincia
Distrito
Circumscrição
Caminhos de ferro

Mavoio hills at 915 metres and at Tetelo (929 metres) made Mr. Marrack suspect that these places were factory sites.

The material used was again rolled pebbles, of quartzite, chalcedony, flint, chert and quartz. Twenty-eight hand-axes were collected; one side is flattened, while the other is convex, sometimes exaggeratedly so. Sometimes part of the original surface is preserved, but more often the implements have been worked all over.

II. The Regions of Galangue and M'Popo (Bie)

Outside the Congo basin, very few sites were known in Angola until recently. Rare implements had been found in Mossamedes, Huila and Luanda, but their origin was uncertain. Now for the first time very perfect implements have been discovered south of the Congo basin in the region of Ganguelas. The implements are Neolithic and were found during the exploitation of alluvial deposits for gold in the valleys of the Cuengué and Xissoi rivers, near the Catholic Mission of Chipindo.

(A) Galangue

The specimens include pierced stones and bolas stones, the former usually of basic rock and the latter of quartzitic sandstone or quartzite. The diameters of the pierced stones range from 6.8 to 11 cm., with heights ranging from 3.2 to 9.2 cm.

(B) M'Popo

The material was recovered from a trench 4 metres high outside the bed of the river Colui in a layer of clay 0.80 metres thick resting directly on the bedrock. It consists of two pierced stones, one of which is very rolled and much used and is composed of a stratified rock. The other is of an argillaceous rock quite different to the material used for the other specimens; it was broken and afterwards well rolled in the alluvium and then again broken.

The material described above can unfortunately offer but little clue to its origin as it was collected either from the surface or from alluvial deposits. Nevertheless these facts emerge:

1. The presence of abundant Lower Palaeolithic implements in Mavoio, in the Congo basin, similar to the Stellenbosch and Fauresmith of South Africa, the Kalinian of the Belgian Congo and the Lower Tumbian of East Africa.
2. The presence of Neolithic implements (pierced stones) in the alluvia of some rivers south of the Congo basin near Ganguellas.

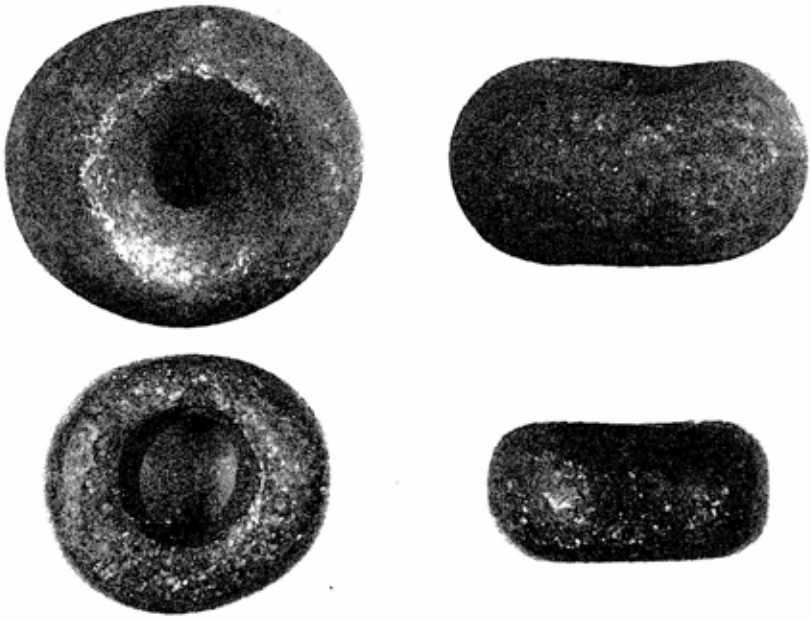


FIG. 1. Bored Stones, Galangue.

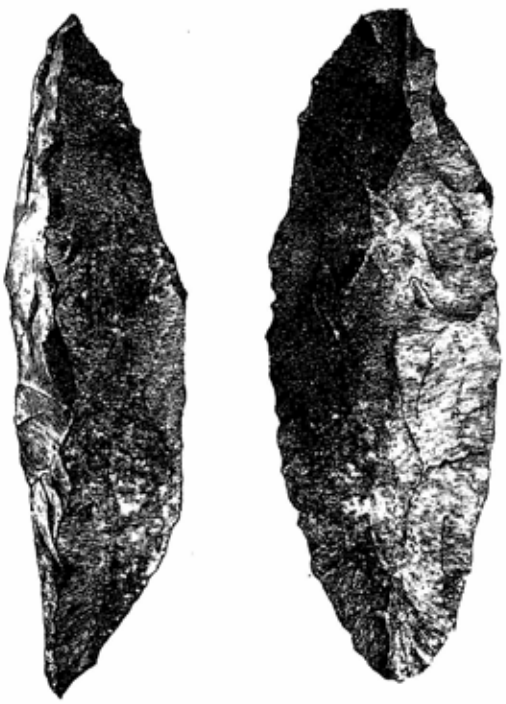


FIG. 2. Handaxe, Mavoio.

[*To face p.* 208

THE OLORGESAILIE PREHISTORIC SITE

L. S. B. Leakey

The Olorgesailie Prehistoric site was found in April 1942, by Mrs. Leakey, and it consists of a series of ancient land surfaces interbedded between lake silts and clays. Upon a number of these land surfaces there have been found extensive living floors of Stone Age Man.

In the main, the artifacts upon these old camp sites belong to different stages of the Acheulean culture, but there is also present, unrolled upon land surface No. 2 and rolled on land surface No. 6, a quite distinct and very primitive flake culture which recalls certain elements of what Mr. Neville Jones called the Hope Fountain culture in S. Rhodesia.

On land surface No. 3 there is also another distinct culture in which crude flake tools and choppers predominate, associated with crudely made hand-axes quite unlike those of the Acheulean industries which both proceed and follow it. Until the material is finally worked out it is not possible to say exactly what this culture is.

Geological deposits at Olorgesailie are comparable with those of Bed 4 at Oldoway and the fossil fauna, much of which comes from the actual living sites, also compares very closely with that of Oldoway Bed 4. On the living sites nearly all the bones found have been broken up to extract the marrow, while skulls have been smashed to obtain access to the brains. So far no evidence of the use of fire has been found on these living floors.

A very interesting feature of the discoveries at Olorgesailie is the presence upon the living floors of hand-axe man of many bolas stones which, in several cases, have been found in quite distinct groups of three.

Quite apart from all the other interesting facts about the site, the geological deposits are of peculiar interest because of the evidence which they show of extensive faulting subsequent to their formation. Detailed geological mapping has been carried out by Dr. Robert Shackleton and these maps will be published, with a report on the site, in due course.

The site has been fenced in and protected and the whole is being developed—with the assistance of the Kenya Government—as a ' Museum on the Spot '.

Monday January 20th

THE MOROCCAN ATERIAN AND ITS SUB-DIVISIONS

A. RUHLMANN

The most discussed industry in North African Prehistory has been the Aterian: its distribution, sub-division and relative chronology. In Morocco the Aterian is found at very many surface sites and is widespread over the whole country, excepting only the Great Atlas range. The sites are often impure (mixed with older or later industries).

The first Aterian industry *in situ* was discovered in 1904 on the El-Hank promontory west of Casablanca and has since been destroyed. The specimens collected from this site were only made known in 1932 in a publication by Dr. Gobert and R. Vaufrey.

A second Aterian horizon *in situ* is described by M. Antoine near Khouribga (central Morocco). He found it near the opening of the tunnels of a phosphate mine, and discovered 'two large points with tangs, one of which is absolutely intact and made from one blade with no retouch except on the tang.'

A third locality was discovered in the old alluvia of l'oued Gorea near Casablanca, where, amongst other industries, is an Aterian horizon *in situ*. The section shows six beds and the main series of implements was found in the fourth from the top which consists of grey sands. This bed can be subdivided archaeologically as follows:

1. A lower level containing quartzites of Mousterian type.
2. A middle level with black Aterian flints.
3. An upper level with microlithic flints of Ibero-Maurusian type.

These levels are not directly super-imposed but merge into one another. The middle assemblage includes simple points, scrapers and blades of traditional Mousterian type together with typical Aterian points with tangs, 'laurel leaves' and one example of a point with tangs showing secondary working on two sides called 'Moroccan'. There is even one burin made from a flake, which is a rare tool in the Aterian. The stratigraphy affords no indication of the relative age of the alluvia and all that can be said is that the Aterian is a late and developed industry.

The problem stood thus until I discovered in the caves at El-Khenzira (south west of Mazagan) two distinct and superim-

posed Aterian levels. The order of succession was exactly the same in the two caves and it follows that the deposits not only proceeded from the same general causes but were contemporaneous. The first of the caves contained but two archaeological levels, while the second contained three. The sequence is as follows :

	Max. thickness of beds	
	Cave No. 1	*Cave No.* 2
A Superficial bed	1m.15	0m.50
B Shell bed with *Helix*. Grey powdery earths with Ibero-Maurusian and fauna	1m.70	0m.75
C Yellow sandy soils with Upper Aterian (II) in both caves and fauna	1m.25	2m.00
D Clayey brown earths with Lower Aterian (I) in Cave No. 2 only ; barren in No. 1	0m.50	1m.50
Total thickness of fillings	4m.60	4m.75

Before the occupation of the B level by the Ibero-Maurusians there was a partial foundering of the entrance to the caves. In Cave No. 1 this falling in blocked one of the exits and in No. 2 there is an enormous accumulation of rock fragments fallen from the roof with snail shells resting on top of it, and wholly overlying Bed C.

The industry of bed D, the oldest and the most archaic from the typological point of view, and which exists only in Cave 2, is characterised by a predominance of tools made from flakes and showing secondary working. The majority have facetted striking platforms. The cores are of two sorts : disc shaped and elongated, with the former predominating. There are also a good many tools with straight and plain striking platforms and a few with oblique platforms. Successive flake techniques co-exist, therefore tending towards the Moustero-Aterian with smooth or prepared striking platforms, which are, however, straight and no longer oblique.

The tools from this level include simple points, or pointed flakes, scrapers, blades, but also a whole range of points and tools with tangs and a massive leaf-shaped point with secondary working on two sides.

This industry is a true but early Aterian and is overlain by a second Aterian bed (C) which can be divided into a lower and an upper level ; it is represented in both caves. The triangular flake again predominates, but the pointed flake is abandoned in favour of a simple point of Mousterian type with the striking side smooth

but the dorsal side retouched. Scrapers and blades persist together with true Aterian types: points and tools with tangs, showing less variety than in the preceding series, and a leaf-shaped point. The cores, mostly discoidal, prove that the technique of construction remains the same as in bed D. It is the secondary retouch which changes: the tools in bed D were only pressure flaked along the edges, whereas those in bed C, which are made of a finer grained material, often show flaking over the whole surface.

Taking these details into consideration, it can be said that the industry of bed C. belongs to a more advanced stage, or a late Aterian. On these grounds I have, since 1936, distinguished between a Lower (early or I) and an Upper (late or II) Moroccan Aterian.

In 1937 M. Antoine summarized the results so far obtained in a paper entitled 'The Atero-Iberomaurusian question in Morocco.' Here the author considers the Aterian to be an integral part of the North African Mousterian and proposes the following subdivision:

1. Early Mousterian (which he qualifies as 'with Acheulean tradition').
2. Middle Mousterian (Aterian I of El-Khenzira).
3. Upper Mousterian (Aterian II of El-Khenzira).

In addition M. Antoine sees a 'hiatus' between my Upper Aterian (II) and the Ibero-Maurusian (bed B) which succeeds it in the two caves. He writes: 'Here one stage of the series is evidently missing. This stage corresponds to the *barren bed which, at El-Khenzira, lies between the Upper Mousterian and the Ibero-Maurusian.* What is the industry which developed during this time lapse'? and he postulates a *Lower Ibero-Maurusian* to fill the gap.

He does not hesitate to turn the accumulations which exist in both caves at El-Khenzira between beds B and C into 'barren beds' used in the archaeological sense of the word. In my treatise I made no mention of 'barren beds', but affirmed, on the contrary, that these accumulations were the result of the 'partial foundering of the caves and found exclusively between beds and B and C.'

Concerning the stratigraphical position of the archaeological level B, I emphasise that it *rests directly* on level C and that the rock debris occurs *locally only* between these two beds. Thus it is impossible to even speculate on an industry which might have existed between them.

To avoid any ambiguity it is necessary to point out that at El-Khenzira there are 'barren deposits' in the lower parts of the cave which make up, besides bed D which is barren from the

prehistoric point of view, the greater part of bed C. In cave 2 the Lower Aterian level (D) is separated from the Upper level (C) by the thickness of bed C. In fact the occupants of the caves lived in No. 1 at the surface of bed C only, and in No. 2 on the surfaces of beds D and C. Long intervals must have elapsed bebetween the different periods of occupation.

In 1939 M. Antoine published the facts concerning the Tit-Mellil site. It is located south east of Casablanca and has been known as a Prehistoric site since 1915.

From the commentary in M. Antoine's paper it appears that the subdivision he introduces in the Tit-Mellil site is founded more on his personal considerations than on irrefutable proofs.

He does not content himself with a general classification of the material collected, but insists on using it to subdivide the Aterian. In my opinion his definition of the industry of the lowest bed as 'Lower Mousterian (of Acheulean tradition)' and the quartzites of the upper beds as an 'Upper Mousterian' is too general. Neither of these two series has the morphological unity which M. Antoine attributes to them, but on the contrary they contain characteristics of various industries, the Mousterian amongst them. The lowest bed seems to have yielded, judging by the published drawings, as well as a few Acheulean tools, at least one made on a flake of Clacto-Abbevillian type.

The quartzites from the upper beds include an ovoid handaxe, a pseudo-*biface* made from a flake with oblique striking platform, simple points (one of which has a large tang), scrapers, blades, borers, notched tools, pebbles with alternate flaking, and a few tools worked on both sides (including the fragment of one leaf-shaped point). Finally under the name of 'Siret's burin', M. Antoine describes implements made from flakes broken longitudinally, but which lack the distinctive mark of the classic '*coup de burin*' and which therefore do not coincide with the definition of the prehistoric burin and its technique as generally understood.

Amongst all these tools, which are far from representing a typical Mousterian by itself, it is easy to pick out, again from the illustrations which accompany the description, a few types characteristic of a final Acheulean, others of the Levalloisian, and others again which can be classed as Mousterian, including the Aterian (leaf-shaped points).

For these reasons I reject the inclusion of this heterogenous material in the Upper Mousterian and M. Antoine's use of the Tit-Mellil horizon as a point of departure for a new classification of the Moustero-Aterian industries.

Apart from the implements in quartzite, the site has yielded, above all, a rich Aterian industry in flint which includes some of the finest tools of this type so far known in Morocco. Together with Mousterian types, such as simple points, scrapers, blades, notched tools, borers, etc. there are others of a pure Aterian—points and tools with tangs. There are also two implements which, if not new, are rare in the Aterian : the *tranchet* and the famous ' Siret's burin '.

Amongst the points with tangs are some examples worked on two sides and provided with wings, called ' Moroccan ', a type which seems to be particular to the Moroccan Aterian. Others are called ' Saharan ', and both resemble certain Neolithic types.

The more common ' leaf-shaped ' points or ' laurel leaves ' are represented by fine and typical specimens.

These flint tools were discovered divided into four zones, the maximum density in the top bed decreasing progressively downwards. Neither the flint nor the quartzite tools were found in a regular stratigraphical position but were dispersed amongst the whole thickness of the sands. This is explained by the extraordinary geological formation of this prehistoric horizon—the industries underwent a mechanical sorting by the waters of a spring gushing out under pressure.

Although the Tit-Mellil group of industries may be varied and mixed one with another, it is above all an Aterian site. The question is whether the flints from the three zones belong to one period of the Aterian or whether they are divided between several evolutionary phases of this industry. M. Antoine believes the material to be distributed between three successive and distinct periods. The Lower and Middle Aterian, he says, ' are certainly represented at Tit-Mellil ', but he is obliged to admit that it is impossible to distinguish between them. Of the Upper Aterian, ' very developed at Tit-Mellil ' he again confesses that ' circumstances unfortunately do not permit of its isolation '.

The author is obliged to leave the stratigraphical aspect on one side and to concentrate only on the technical side. Certainly compared to the Aterian II of the upper bed (C) at El-Khenzira, the industry of Tit-Mellil is ' infinitely richer in industrial types '.

In appreciating the technical aspect of an industry, the importance of the material used should not be underestimated. The flint used at Tit-Mellil lends itself far better to the careful fabrication of tools than does the material used at El-Khenzira. It should also not be forgotten how much similar industries vary from place to place ; it may be by the presence of absence or a certain tool.

Another Aterian site, at Dar es-Soltan, was excavated in 1937 and 1938. It consists of a vast cavern, situated beside the sea south west of Rabat, hollowed out of a Quaternary consolidated dune by the waves. The stratigraphy from top to bottom, in the inverse order of accumulation of the fillings, is as follows :

A. Grey powdery earth of recent origin. Present day fauna, 0m.65.
B. Black earth with a Kitchen Midden containing a Neolithic industry of Ibero-Maurusian tradition. Recent fauna, 1m.60.
C. Brownish yellow earth, sandy clays, locally separated from bed B by a large accumulation of fallen material. Quaternary fauna, 1m.75.

From the archaeological point of view this last level is subdivided into :

C1. An upper horizon with an atypical industry of final Palaeolithic type.
C2. A lower horizon (seaparated from the preceding one by about 1m.50 of barren earths) containing an Upper Aterian (II) industry.
D to H. Five distinct beds of sandy clays, barren from the archaeological point of view.
I. Brown clayey soil with Lower Aterian (I) industries and fauna, 0m.30.
J. Dark brown clay, barren 0m.50
K. Fine sand, barren 0m.30
L. Consolidated bed from a lagoon deposit 0m.20
M. Shelly sand from the beach 0m.35

Apparently pre-historic man occupied this cave at four distinctive periods, far separated in time, at the levels of beds I, C2 and C1, and finally B.

The tools in bed I, the lowest and consequently the oldest, consist of cores (mostly discoidal), pointed flakes, simple points, scrapers, blades, borers, etc., a Mousterian assemblage with the addition of points and tools with tangs. There are no special types of points. There are, however, two ivory objects which are new to the Aterian. The industry has a characteristic Aterian typology—the association of tools with tangs and a typical Mousterian assemblage. As this first Aterian horizon is overlain by a second Aterian level (C2) which is more developed, it is permissable to call the industry of bed I a *Lower Aterian* (I).

The industry of C2 includes, as well as the traditional scrapers,

blades, borers, etc., a fine series of points. There are flake-points, simple and tanged types, 'Moroccan' (one example), 'leaf-shaped' (one example) and 'laurel leaves' (two examples). The only type missing is the 'pseudo-Saharan'. In addition there is a rare tool—the *burin busqué*. This industry is equally typical of the Aterian, and besides representing a more developed phase than the industry of bed I, by its stratigraphical position it merits the name of *Upper Aterian* (II).

In the C1 horizon this evolutionary line changes abruptly. The industry of this level has been found between the contact surfaces of beds B and C, indicating that it was formerly situated at the top of bed C. It is now separated from C2, which used to be directly beneath it, by about 1m.50 of piled up barren earths.

The remains found in this third oldest occupation of the cave were discovered grouped into two sharply divided areas of distribution. It is probable that these materials, which nevertheless belong to one archaeological level only, came from two factory sites which, without being contemporary, succeeded one another within a short space of time. Although the main character of each is the same—they were both made from the striking platform technique—they show a few minor variations.

The tools of the first group are at first rather coarse. The flakes from which they are made are nearly always just reshaped, and more rarely show secondary working. There are pointed flakes, with a few developing towards the Mousterian point, a few scrapers, blades and a notched tool, but with *no tools of Aterian type*. There are also types which have no connection typologically with those with which they are mixed—one crescent of medium size, with a finely worked back, and one or two rectangular implements worked on two sides.

In the second group, composed mostly of flakes casually reshaped on the dorsal side, are found also a few flake-points. Here too there is a *total absence of tools with tangs of Aterian type*.

These two groups represent the lateral branches of one sole industry, which can only be attributed to a final and decadent Mousterian belonging chronologically (confirmed by its stratigraphical position) to the ultimate phase of the Upper Moroccan Palaeolithic. The industries of levels I, C2 and C1, therefore, may be included in the Moustero-Aterian group, with the important distinction that the first two are characteristic of the Aterian, while the last is a final Mousterian.

Comparing the Aterian series with the corresponding one at El-Khenzira, practically the same assemblage of tools is seen in

levels I and II, apart from a few exceptional types (particularly the 'special' points). On broad lines the industries of these horizons have enough affinities to justify their attribution to a *Lower* (I) and an *Upper* (II) Aterian.

We have seen that the Aterian II at Dar es-Soltan is overlain, not by an Aterian III as M. Antoine would have it, but by a decadent Mousterian. The explanation of why the evolution of the Aterian is arrested at the C1 level at this site seems to lie in the stability and continuity of the Mousterian element running through the Aterian industries. Only the results of further excavations will show whether this concerns a general evolutionary stage, a local or regional event, or simply an isolated case.

Another interesting point is that the accumulations of rock debris fallen from the roof are encountered both at El-Khenzira and at Dar es-Soltan in exactly the same stratigraphical position: between the end of the early deposits (containing Aterian II at the former and the decadent Mousterian at the latter site) and the more recent deposits (snail shells and Ibero-Maurusian industry at El-Khenzira, a kitchen midden with an industry nearer to the Neolithic than the Ibero-Maurusian at Dar es-Soltan). The similar position of these two founderings proves (1) that they arose from the same geological cause and (2) that these blocks in no way correspond to M. Antoine's 'barren beds' nor to his no less hypothetical 'Aterian III'. The Aterian in both these sites is divided not into three but into *two* distinct and superimposed levels.

Classification of the Aterian

The subdivision of the Aterian, based on the only places where it has been found *in situ*, thus confirms the classification proposed in 1936 which is as follows:

(*a*) *Lower Aterian* (I or early) represented by the industry of bed D (cave No. 2) at El-Khenzira and bed I at Dar es-Soltan.

(*b*) *Upper Aterian* (II or late) represented by the industry of bed C (in the big caves) at El-Khenzira and level C2 at Dar es-Soltan.

The material at Tit-Mellil, I believe, can be included in these two subdivisions as follows:

(*a*) *Lower Aterian.* Implements made on oval or triangular flakes with pronounced Mousterian affinities; secondary retouch on one side; co-existence of simple points and points with tangs; appearance of points worked on two

sides of leaf-shaped or 'laurel leaf' type; absence of special points called 'Moroccan' or 'pseudo-Saharan' and of the burin.

(*b*) *Upper Aterian.* Persistance of the Mousterian tradition in an industry turning more and more towards the typical Aterian; abundance of points and tools with tangs; secondary working generally more marked than in the preceding level, encroaching in certain cases on the striking side; the simple point is produced, not from a broad, short flake but from a blade; presence of tools with secondary working on two sides; occurrence of leaf-shaped points but with 'laurel leaves' predominating; first appearance of a few new forms: rare burins, points with wings ('Moroccan') and lozenge-shaped points ('pseudo-Saharan').

In these two levels flint is employed almost exclusively. Considering that the point with tangs is well defined in the Lower Aterian, it would appear that it must have started in the Upper Mousterian where a few rather massive tools with tangs are first seen. This industry, of which the Aterian is only a lateral branch, has never yet been found *in situ*, and further discoveries are needed before the origin of the Aterian and several other obscure points concerning its evolution, distribution and relative chronology can be elucidated.

The classification given above is not rigid or absolute in any way and applies only to the Moroccan Aterian. The classification in other North African regions remains to be worked out.

Chronology of the Aterian

The question of the relative chronology of the Aterian is much more controversial than its classification. Some believe that it originates in the Middle Palaeolithic, others in the Upper Palaeolithic. Personally I incline to the second of these two views, in spite of having defended the first during my work at El-Khenzira. Recent knowledge of general stratigraphical facts concerning the Moroccan coastal Quaternary, as well as the stratigraphical and archaeological interpretations of the cave at Dar es-Soltan, have led me to change my original opinion.

Relating to the chronological problem concerned is the separation of the Quaternary marine transgressions, and the following levels have been recognised:

±90 to 100m. (Sicilian).
+55 to 60m. (Milazzian).
+28 to 30m. (Tyrrhenian).
+12 to 15m. (Grimaldian).

As the sea stood at at least four levels higher than at the present day, it follows that the Pleistocene areas along the Atlantic coast do not belong to the same geological formation. On the contrary, four distinct marine sedimentations can be recognised, alternating with land deposits.

The cave at Dar es-Soltan was formed in a ' dead ' cliff originating from a dune, whose platform is 18m. above present sea level. The caves at El-Khenzira are at least 25m. above sea level. The caves in both places were made by the action of the waves, and only the ' Grimaldian ' sea at 12–15m. could have originated their formation.

The beach bed of sand with shells (bed M) at Dar es-Soltan on the floor of the cave is at + 9m. altitude. Its stratigraphical position and more especially the marine fauna found in it indicate clearly that it could only have been deposited by the last Quaternary transgression of 12–15m.

The ' Grimaldian ' transgression was more or less contemporaneous with the last great North African Pluvial, which in its turn synchronises with the last European glaciation (Würm). Remembering that the caves were only habitable after the Grimaldian sea had retreated, their occupation must have occurred during the post-pluvial phase (or post-glacial in Europe). Aterian man must have lived in them, then, in Upper Pleistocene or Upper Palaeolithic times.

From the stratigraphical point of view, the Aterian is not found at the base (this is particularly clear at Dar es-Soltan) but at the top of the early deposits. The bottom deposits are sub-aerian sandy clays—derived from red muds, and could only have been caused by climatic changes characterising the last Pluvial. M. Arambourg emphasises that ' local stratigraphy shows traces of this humid period in the development of red beds, clays formed by decalcification and fluviatile deposits which filled the caves.' This same specialist of North African geology also declares that these red beds, which exist equally along the Algerian coast, and the bottom fillings of the caves which are derived from them, belong ' chronologically and causally ' to the final phase of the ancient Quaternary in North Africa. It follows that the Aterian industries which are found in the upper part of these beds are inevitably later than the period of their deposition. In fact they belong to the post-pluvial phase, and this position does not alter the fact that the origin of the Aterian must be sought in the Upper Mousterian.

The Aterian horizons in Morocco found *in situ* belong then

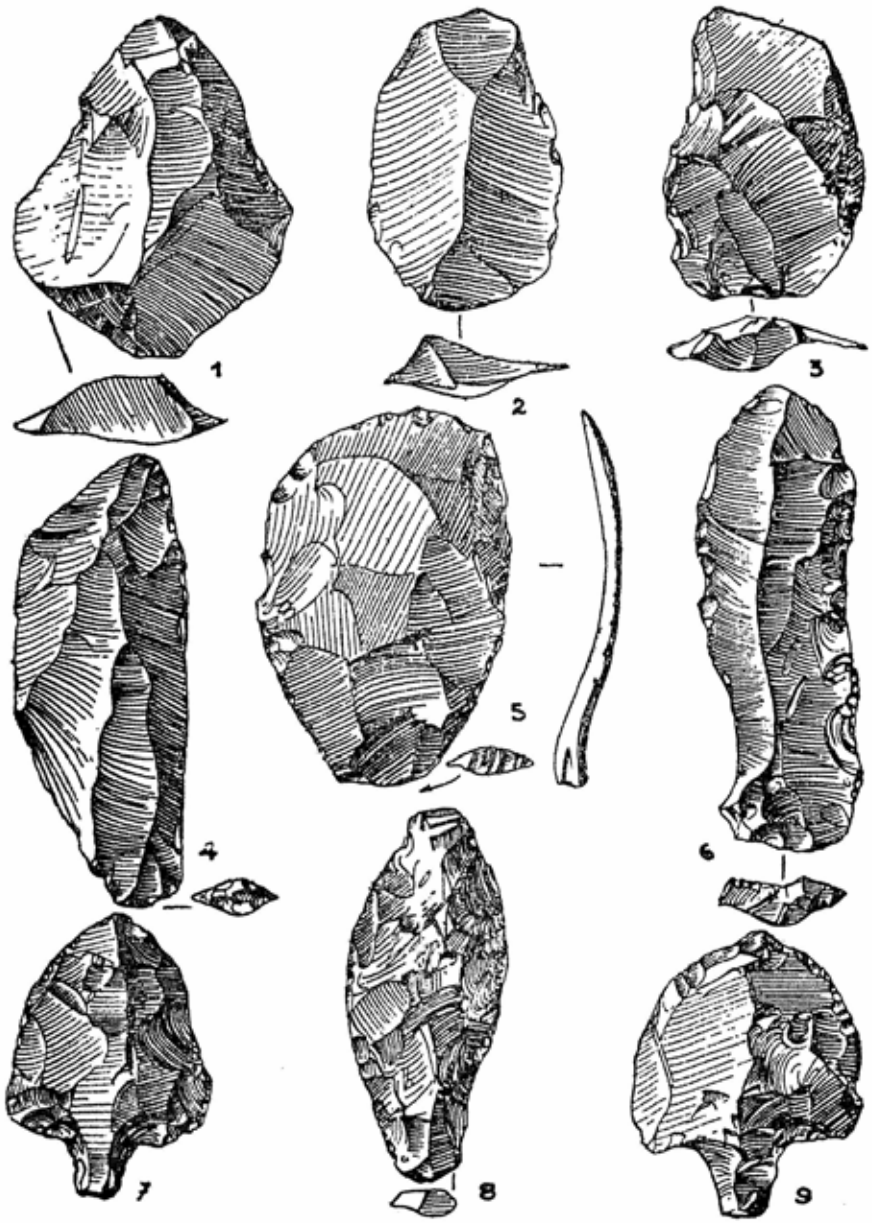


Fig. 1. Cave No. 2 at El-Khenzira, Morocco. Lower Aterian Industry. Material: flint. Nos. 1 and 2, flake-points; Nos. 3 and 5, scrapers; Nos. 4 and 6, blades; Nos. 7 and 9 tanged points (Aterian points); No. 8 leaf-shaped point showing retouch on both sides.

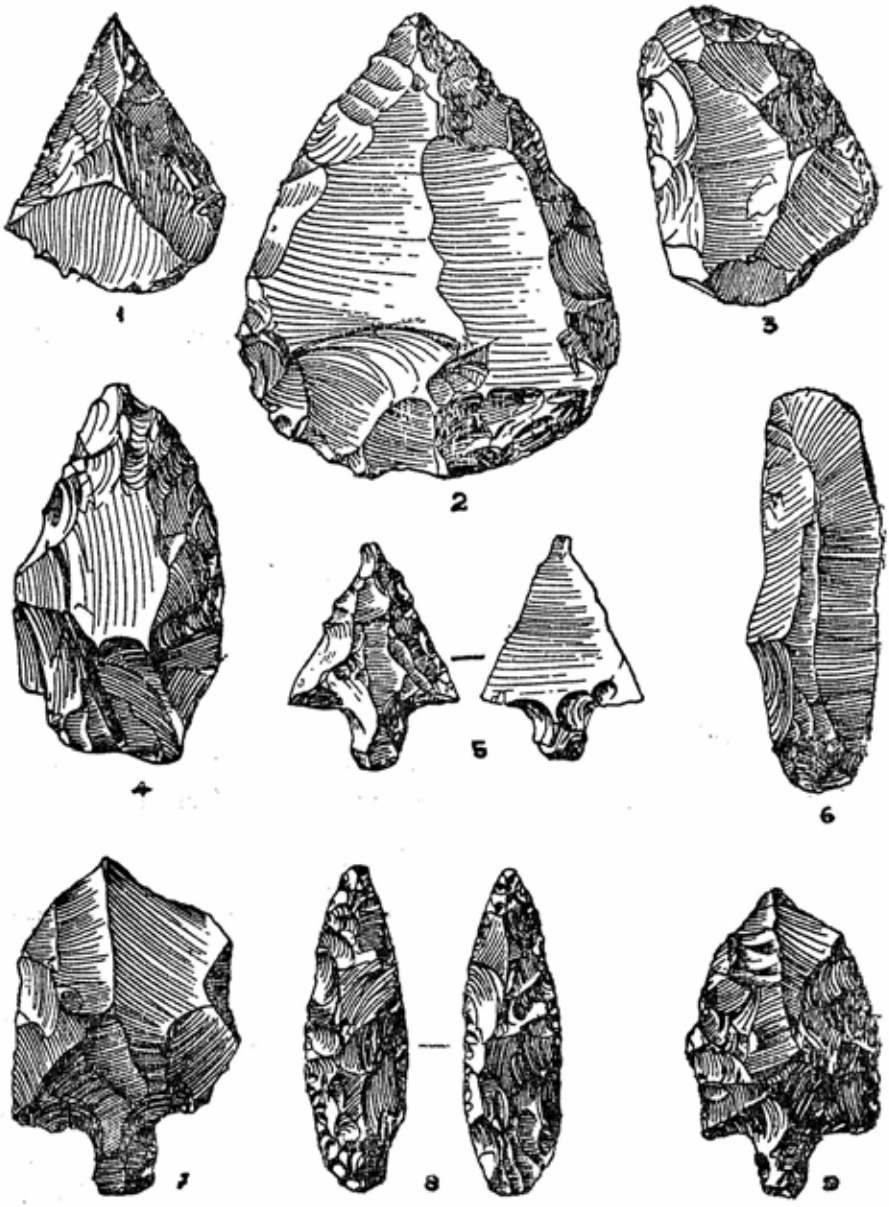


Fig. 2. Caves at El-Khenzira, Morocco. Upper Aterian Industry (represented in both caverns). Material: flint. Nos. 1 and 2, points; Nos. 3 and 4, scrapers; Nos. 5, 7 and 9 tanged points (Aterian points); No. 6, blade; No. 8 laurel-leaf point.

to the Upper Palaeolithic and constitute (apart from the decadent Mousterian of C1 level at Dar es-Soltan) the only industry so far known in this country attributable to this period.

The Ibero-Maurusian consequently must be included in the North African Mesolithic, which is confirmed by its stratigraphical position between the final Upper Palaeolithic Aterian and the Neolithic.

To be complete, the fauna too must be taken into consideration. The characteristic elements of these red beds comprise, as well as an ancient fauna, a certain number of new species of which ' certain ones indicate, by their presence alone, important climatic changes '. The vertebrate fauna which accompanies the Aterian industries found in stratigraphical position is characteristic of the Upper Palaeolithic.

THE PRESENT STATE OF OUR KNOWLEDGE CONCERNING THE PREHISTORY OF CAPE VERDE

R. Mauny

SOME PHYSIOGRAPHIC PROBLEMS RELATED TO THE PREDYNASTIC SITE OF MA'ADI

M. Amer Bey and S. A. Huzayyin

In 1940 excavations took place at the S.W. fringe of the Ma'adi Predynastic site, a few kilometers to the S. of Cairo. At this fringe the settlement comes nearest to the level of the cultivated land and the flood plain ; and it was thought useful to try and fix the limit of the settlement and its place in relation to physiographic cycles of erosion and deposition in the main valley. It was therefore decided to dig a trench through the settlement layers, and to go down to the rock-bottom if possible. The trench was some 12 x 2m. and it went down through the settlement layer (at 31m. above level sea) and sandy layers until it reached the surface of the bottom layer of Nile silt (at 28m. above the sea), through which we dug to a level of 9m. from the surface of the settlement. The silt then gave way to sands (presumably Nile sands?) at 22m. above the sea. In addition, borings were made both to the west

and the east of the trench ; the former by the Delta Land Investment Co. of Ma'adi, and the latter by the Faud I University excavating staff during subsequent seasons. As a result, two series of Nile silt were established, apart from the present accumulation of silt forming the cultivated land of the flood plain at 20m. above sea level. The first series lies between −27m. and almost sea level (though it may still prove to reach higher levels in future borings), while the second one ranges between 15m. and 39m. above sea level with the bottom of the mud layer rising towards the outer edge of the valley. It is interesting to note that similar double series of Nile silt were traced also at Turah 3 klms. to the S. of Ma'adi, where the lower silt was found to rest on an implementiferous layer containing a microlithic industry of Final Palaeolithic appearance. Mineralogical examination of silts at Ma'adi and Gurah has shown that they are all identical in composition with present day alluvium.

From a study of the sections and borings made at Ma'adi and their comparison with the sections exposed and excavated at Turah, the following sequence may be suggested.

1. In the Upper Palaeolithic, the Nile was degrading its bed and the valley was excavated at least to the depth of −27m. (below present sea level) opposite Ma'adi.

2. Then in Final Palaeolithic or Preneolithic times a quick movement of aggradation took place. The bottom of the valley was quickly filled up with sands and mud, mostly of Abyssinian origin. Abyssinian silt appears to have been accumulated in two series, and during particularly high floods the waters silted mud on the outer borders of the valley at a height reaching 39m. above sea level or some 18m. above present flood plain.

3. Then the Nile level seems to have subsided and lateral erosion took place on its outer edges. Torrents descending from the eastern desert eroded the soft silts in places, and left them in others. Erosion of silt, however, was followed by deposition at the mouth of Wadi Diglah which skirts the site of Ma'adi to the S. and S.W. Coarse gravels and sands were then deposited reaching various heights, round an island of the old silt which seems to have been gradually covered and protected by surface wash of sands and fine rubble.

4. On this island the settlement of Ma'adi was established during Middle and Late Predynastic times.

5. As the settlement came to an end, a new cycle of erosion too place at its S.W. fringes, which were again exposed to torrent

activity from Wadi Diglah. Part of the settlement was eroded before deposition of new gravel and sand took place. In the gravels tools from the settlement were found somewhat battered.

6. In these new deposits mild erosion again took place and the surface was irregularly cut until fresh deposition took place, in this case of fine sands and occasionally of very fine banded yellow silt in pools caused by rain or fed by water from torrents.

Thus since Upper Palaeolithic times we had at the outer edge of the Nile valley in the Ma'adi locality the following sequence: deep degradation in the Upper Palaeolithic, quick aggradation and accumulation of Nile silt in a double series; erosion of silt by lateral activity in places; deposition of coarse gravels and sands; growth of settlement in Middle and late Predynastic times; local lateral erosion of settlement fringe; local deposition of gravel and sand; mild erosion of surface; and local deposition of fine sands and soft yellow silts in surface pools. Thus Ma'adi provides a good example of the way in which archaeological and physiographic investigations may link together with illuminating results.

RECENT DISCOVERIES CONCERNING THE PALAEOLITHIC OF CAPE VERDE

T. Monod

THE OCCURRENCE OF CLACTO-ABBEVILLIAN (STELLENBOSCH) ARTEFACTS IN NORTH EASTERN ANGOLA

J. Janmart

The area where I carried out my researches is situated in the north-eastern corner of Angola, in the concession of the *Companhia de Diamantes de Angola*, on whose staff I am. It seems a pity that, at this Congress, I am the only delegate of a private company and it is much to be regretted that other powerful concerns are not periodically represented at scientific congresses in Africa.

This area is crossed by two river systems: a fossil one, whose general slope is from south-east to north-west, and a modern one running from south to north. I shall discuss a cross-section of the area in which these two systems are represented.

A site at Musolexi, where a flat topped hill is being removed for mining purposes, has furnished the main cross-section. The bed on which the fossil river once flowed is an ancient, pre-Lubilash channel, about one kilometre in width, the bottom of which is situated 40 metres above the water level of the Luana river. At Musolexi the bed-rock is gneiss, but at other sites it is granite or mica-schist, or again pre-Lubilash schists and quartzites. It is deeply weathered, to more than 15 metres at Musolexi, but whether this extraordinary depth of alteration is due to pre-Lubilash climatic conditions or to more recent soaking, I do not know.

The depth of the gravel layer ranges from zero at the rim to 5 metres in the centre. The bulk is composed of large subangular or rounded boulders and pebbles, mainly of Lubilash sandstones, conglomerates and feldspathic sandstone that once covered the landscape, the remnants of which are to be found only a few hundred metres from the spot, on the plateau.

The gravel is typical of a semi-arid climate : it is unstratified, and boulders and smaller pebbles are evenly distributed throughout the whole mass and are not necessarily lying on bed-rock as is the case with gravel laid down by perennial streams and rivers.

Dr. Beetz has called this gravel sheet Pleistocene. It is, however, pre-Miocene, since it does not contain any polymorphic sandstone, which is a product of a secondary silicification of sands and gravels, of Miocene age, very abundant on the neighbouring plateaux and the exclusive component of the upper gravels. It is obvious that this gravel sheet would contain some of the polymorphic sandstone if it really were Pleistocene.

Beetz, however, only saw outcrops of the gravel sheet, on the slopes of Xatuca creek, not far away, where that creek had cut through the fossil gravel sheet. Middle Stone Age people worked on that outcrop and used its pebbles as raw material for their artefacts. The refuse that was left behind Beetz mistook for a culture dating the layer.

The second layer also averages 5 metres in the centre and thins out to zero at the margins of the fossil valley. The material is coarse, reddish, slightly violaceous sand, with a fair proportion of kaolin, and was obviously derived from the same Lubilash beds as the underlying gravel. It is stratified and often cross-bedded. Thin patches of pebbles, seen as seams in the cross-section and only 3 to 10 cm. thick, are found in the stratification. This points to increased desertic conditions and I have called this layer Kalahari Sand A.

In the classification adopted by the Geological Congress at

Leopoldville in 1946, the Lubilash was integrated in the Kalahari system as Kalahari I, the polymorphic sandstones as Kalahari II and the red sands as Kalahari III. In speaking of these sands in this paper I have called the lower sands 'A'.

While in the valleys there still remained some amount of perennial or periodical moisture, on the plateaux the desert was the master and the sands and gravels derived from the alteration of the Lubilash sandstones and conglomerates were being silicified secondarily into polymorphic sandstones, of Miocene age, known as Kalahari II. Then semi-desertic conditions set in again and the top part of the sand layer was ferruginised near its surface to a depth of about 1 metre.

Climatic conditions then became more humid and the polymorphic sandstones on the plateaux were weathered and broken up. The products of the alteration, pebbles, sand and large boulders, were deposited on top of layer A and on the slopes. This was done by a hydrographic system different from the one represented by the bottom gravel layer plus A, which compose together what I have called the fossil river. In the meanwhile the land surface had acquired a new general slope towards the north as a consequence of the lifting of the continent somewhere in the south. This movement was perhaps related to more important movements of the Miocene period in the east, at least during the early part of the uplift.

The formation of the gravel layer under review, derived from Miocene rock, is thus either Miocene or post-Miocene. I consider it to be Pliocene, even late Pliocene, because we are here quite close to the appearance of human artefacts. This implies that the duration of the silicification was a long one, which is confirmed by the very great thickness the polymorphic sandstone beds attain in certain areas.

This same gravel layer is stratified and, though not very thick, (it rarely exceeds one metre) it contains huge boulders, facts that prove that the rainy period it represents, the pluvial or at least local pluvial period, was short, but with a heavy rainfall. The stratification, in particular, proves the presence of a perennial river, which only a steady rainfall could produce. The layer is ferruginised, which shows that after its formation, *i.e.* after the pluvial period, a new phase of semi-desertic character, or at least a period with alternating and well differentiated dry and wet seasons, set in.

We come finally to the upper layer which, from the prehistorical and still more from the palaeontological point of view, is most

important. It is nothing but red Kalahari sand and has, at Musolexi, a maximum depth of about 30 metres. However, I have measured depths of 42 and 45 metres in other places and Mouta has recorded a depth of over 90 metres at Camissombo, about 100 km. to the west. At the base there are, mixed with sand, small grains of quartz and laterite derived, by aeolian action, from the underlying gravel layer. Higher up this red Kalahari sand, which might be called III B, is unstratified and contains no traces of vegetable or animal life except of the toughest of them all : man.

The artefacts I have found, evenly distributed in the lower 15 metres, are of two types :

1. Rolled : a pebble industry which I consider to be a somewhat archaic Oldowan, perhaps Kafuan.

2. Unrolled : Clacto-Abbevillian (Stellenbosch I) material, which consists of (*a*) artefacts made on cores : heavy roughly made picks, pear or spool-shaped, with a more or less circular cross-section, of Abbevillean typology. (*b*) Artefacts on flakes : Clacton type cores and flakes with flat striking platforms and wide angles ; large flakes roughly trimmed that may have been used as choppers or scrapers.

All these implements have a length of 15 to 30 cm. and are made of quartzite, vein quartz or sandstone, all material available on the spot or in the neighbourhood.

From the typological evidence it may thus, tentatively, be inferred that :

1. The pebble culture is younger than the Kalahari sand III B, and possibly contemporary with the underlying layer, which would then represent the Kageran Kisegian, Pluvial.

2. The Kalahari sand III B is, in this area, contemporary with Vaal Stellenbosch I.

Wednesday, January 22nd

THE ROCK PAINTINGS OF FRENCH ZEMMOUR, WESTERN SAHARA

T. Monod

Captain Cauneille discovered two localities of rock paintings in Zemmour : in the sandstone massifs of Oummat Chegag and Oummat el Lham, about 35 km. to the north-west and 50 km.

north-north-west of Bir Moghrein (Fort Trinquet) respectively. The paintings at Oummat Chegag are found in caves in the sandstone, while those at Oummat el Lham are dispersed amongst the scree from the northern bluff facing the *oglats* of Aouineght.

The Zemmour paintings include those of wild animals (elephants, giraffes, antelopes, rhinoceros, ostriches) and domestic cattle. Human figures are nude or semi-nude and show pronounced steatopygia. Some are armed with bows, while two seem to be holding round shields (though there is nothing to prove that these figures are of the same age as the rest) and several have animals' heads. Although the human figures are crudely drawn, the animal paintings are often excellent, particularly those of running animals.

It would seem that this material belongs to the first half of the great Pastoral Group (before the appearance of ' diabolo ' figures with their kidney-shaped heads and armed with lances and shields). In other words, they belong to the series of Bushmanoid paintings known from the central and eastern Sahara and which are apparently connected with those of the North African desert.

Saharan rock paintings were examined in great detail by P. Graziosi (*L'arte rupestre della Libia*, 1942) and some of his conclusions may be quoted. (1) It is extremely difficult to arrive at more than a very approximate chronological sequence for the material ; (2) it is uncertain whether the Period of Horses should be placed between the Pre-camel and Camel Periods. Possibly it should be distinguished as an intermediary group in the general sequence of : (*a*) antelopes ; (*b*) cattle ; (*c*) horses ; (*d*) camels. J. M. Santa Olalla interpolates a ' Proto-camel ' Period between the Cattle and Camel Periods, followed perhaps by a ' Libyco-Berber ' and an ' Islamico-Berber ' Period.

Winkler and Graziosi have respectively named the style used for portraying the human figure as that ' of balanced exaggeration ' and ' bi-triangular '. The terms ' hourglass ' (F. R. Rodd) or ' diabolo ' in common use for this style are not less descriptive. This style, associated with a certain type of clothing, was important in the eastern and central Sahara during the second half of the Pastoral Period. In the western Sahara the style which succeeded it elsewhere (the non-bi-triangular Libyco-Berber group with round shields, horses, carts and later camels) may possibly occur during the beginning of the Pastoral Period.

It is important to distinguish between the true bi-triangular figures and those which are triangular only above the waist (square shoulders and slender figures). Those showing steatopygia can

alone properly be designated Bushmanoid. The expression 'Hispano-African art' should be confined to that which portrays the Bushman type, excluding the bi-triangular which was properly speaking a later style.

It is remarkable that there seems to be no sure distinction between the men of the Antelope Period and those of the first Pastoral or Cattle Period. The relatively early appearance of cattle seems assured, as they are portrayed from the beginning of the period of fine naturalistic paintings in southern Oran, Tassile and Fezzah. The word 'relatively' is used since the antelope group, as well as the early part of the cattle group, is probably Neolithic.

In attempting to draw up the succession of the Saharan rock paintings, it must not be forgotten that local facies existed then just as they do to-day and that cultural influences met with obstacles, delays, sudden advances and periods of stability.

In the Egyptian desert the antelope group is entirely absent, while the cattle group seems to have covered the whole of the Sahara, although it may have terminated at different times in different places.

ROCK PAINTINGS AT MOUNT CHINHAMAPERE, SERRA VUMBA, MACEQUECE

P. DA CARVALHA

For some time I have known of the existence of rock paintings on Mount Vumba, where animals are portrayed which are called 'horses' by the natives. After various attempts I finally managed to discover the so-called 'horses' on the top of Mount Chinhamapere on the slopes of Mount Vumba. The figures are to be found on a smooth, high rock, intercepted by another almost at right angles to it, thus forming a side sheltered from the wind and heavy rain. On the smooth rock many figures have been painted, some in bright colours, others faded and less recognisable.

Warriors are depicted with bows and arrows, men either dancing or fighting, and various animals, amongst which can be recognised gazelles and other antelopes and, apparently, a rhinoceros and a bird. The technique followed in these designs is not always the same; sometimes the figures are coloured all over, in others the body and spine are outlined, while yet others are stylistic figures reduced to simple lines. The figures are often superimposed, at times in a maze of undecipherable lines. The colours used vary

from dark reddish brown to yellow ochre. Similar figures and colours superimposed in this way have, of course been found in various parts of Africa.

These rock paintings include, however, some unusual characteristics and this fact, together with the intention of recording one more locality where they have been found, has led me to make this communication.

Human figures predominate and may be classified as follows :

(1) Large figures, out of proportion, crudely painted in yellow ochre. Some of these figures are so faint as to be hardly distinguishable, with others of slightly more vivid colouring superimposed upon them. Although the animal figures are well painted, the humans are very deformed ; their legs are not depicted, giving the impression that they are dressed in long tunics. Among the animal figures accompanying this group, antelopes with large humps predominate.

(2) Figures of a blood red colour, with animals superimposed on the earlier ones. The figures of animals are well drawn, antelopes again appearing with humps. The human figures include various types :

(*a*) Elongated, the body painted with vertical strokes giving the impression of a tunic and the legs invisible.

(*b*) Figures superimposed upon the previous group, the colour slightly more vivid, painted in full, relatively long, legs drawn separately, the sex well marked in some and the thighs developed ; some of the figures hold bows.

(*c*) Also in blood red colour, but the figures are stylised with crude tracing outlining the shape of the body and spine ; they appear to be dancing. They are accompanied by an animal, in the same colour, which is difficult to identify (Fig. 1).

(*d*) Again in blood red colour, the legs with indications of the knees and feet, the sex well marked. The figures are badly preserved. In a group of two figures, one of them appears to be hitting the other.

3. Dark reddish brown colour. The bodies are in proportion and well drawn and the figures form a warrior-like frieze with quivers and bows. The bodies have projecting navels and the sex is well marked ; the toes are depicted (Fig. 2).

This frieze is detached from the rest. The heads are missing, only the hair being painted. The heads were either omitted on

FIG. 1

FIG. 2

purpose or were painted with pigment which has disappeared with time. I have frequently found figures without heads, but in this case the hair is indicated. It is also to be noted that there is a discontinuity at the knees, due I think to the use of a different paint which served to indicate rings. It seems reasonable to suppose that the faces and heads (excepting the hair) were painted with the same pigment as the rings on the knees and that this paint has not survived.

The umbilical hernia which appears in all the figures of this frieze is also to be seen in natives of the present time.

Three more paintings were found, one depicting a gazelle and, not far from the first, two extraordinary animals of blood red colour with elephants' trunks and an ear in the middle of the forehead. These two figures were found more than 3 metres above the ground, on a high rock on another slope of Mount Vumba.

NEW ROCK ENGRAVINGS OF THE WESTERN SAHARA

T. Monod

The discovery made by Captain Cauneille of numerous sketches of carts engraved on rock slabs near the Aouineght '*oglats*' in French Zemmour brings a new contribution to the question of proto-historic engravings of carts in the Sahara.

The engravings on these rock slabs, apart from rare and imperfect human figures, include representations of wild and domestic animals and a remarkable series of carts, over 100 in number, or twice as many as have so far been recorded from the whole of the Sahara. Although most of the Aouineght material belongs to the Pre-Camel Pastoral Group, some of the images of cattle seem to be older than the carts.

The carts are mostly 15 to 45 cm. long, with one exception which is 1m. 20cm. long. The problem of the Saharan carts started in 1864 with Duveyrier's publication concerning figures of carts at Anai (Fezzan), while in 1926 F. Rennel Rodd noted an engraving at Ahu Maqaran (Air) of oxen drawing an object which 'must apparently be a cart.' From 1933 onwards similar discoveries have been numerous in a great number of localities.

P. Graziosi has recently collected so much information about the Saharan carts in the chapter entitled 'I Carri' in his work on the rock paintings in Lybia (1942) that there is little to add. The

first major division in the classification of the carts is according to the number of wheels : 2 or 4. This classification may be further subdivided as follows :

A. Carts with two Wheels (representing nearly all the material).

1. *Carts with two wheels and one pole.*

(*a*) *Normal type* with two horses, the type of battle chariots, ending in a kind of halter : two circles joined by one or two bars. The cart is rectangular, square or sometimes rounded in front. The yoke is often indicated.

(*b*) *Aberrant type* : the carts are very long, and rounded or pointed in front (four examples known).

2. *Carts with two wheels and two shafts.*

The classification of this type depends on the form of the yokes (double or single) and the number of horses (one, two, three or four). Many of the figures are too incomplete for classification.

3. *Carts with two wheels* (*and more than two poles?*)

Some of the examples may have three poles. Others present a problem in that six straight lines go forward from the axle whose purpose is unknown.

B. Carts with Four Wheels

Are there in fact carts with four wheels? A few of the designs lead one to think so ; thus there were transport carts as well as battle chariots. This would link up with Pliny's description of the *plaustra* of the Numidians and those of the Getulians mentioned by Silius Italicus. Evidently classical archaeology can help to interpret the designs of the engravings, though in view of the rudimentary nature of most of them, drawn probably haphazardly by unskilled shepherds or warriors, it is unwise to attempt to draw the comparisons too closely.

There are few conclusions to be drawn from the distribution of the engravings, as the regions in which they are not found are no doubt only those which did not lend themselves to carving on stone. The two principal zones are those of Tassili-Fezzan and the Atlantic Saharan and South Moroccan group : two advance regions of Mediterranean influences on one hand and on the other a desert region, occupied at the time of the carts by pastoral people who came into contact late with the Libyco-Berber element.

The apparent absence of carts in the Egyptian desert at El

Aouenat and Tibesti is remarkable. It seems that the type with one pole is commoner in the west (Zemmour) than in the east (Fezzan) where carts with two shafts predominate. There is no archaeological record of the Saharan carts, nor is there any record of a late survival of this method of locomotion. Concerning the chronological problem, it appears that the carts of Tassili, Lybia and Zemmour belong to the Pastoral Pre-camel Period with oxen, while those of the south (Adrar, the Sudanese Sahara) seem to be already of the Libyco-Berber Period. The division between the Pre-camel and the Camel Periods must, however, be an arbitrary one since (1) the period of horses preceeded the latter (probably by a long time); (2) the people of the end of the Pre-camel Period and the beginning of the Camel Period probably belonged to the same ethnic group (beginning with bitriangular figures of herds with javelins and shields other than round and followed by figures with round shields). Possibly the Libyco-Berber warriors with round shields followed directly on the archaic Bushman-like archers.

THE INFLUENCE OF CLASSICAL CIVILISATIONS ON THE CAVE PAINTINGS OF SOUTH AFRICA

Abbé H. E. P. Breuil

Although an immense distance separates the cave paintings of eastern Spain from those of South Africa, their style is so similar that there can be little doubt about their connection. It is apparent too that part of the rock paintings of East and South Africa are just as ancient as are those from the Palaeolithic of Spain. We should therefore expect to find in South Africa, behind representations of Europeans of the 19th century and of Bantus and Zulus (which cannot be older than the 17th and 18th centuries), pictures of strangers such as Arabs, Indians and mediaeval Chinese as well as people of the Mediterranean and classical civilisations.

Coins found in South Africa of Hebrew, Egyptian and Greek origin point to the contact which existed between the natives of South Africa and Mediterranean peoples, and there is no lack of other similar evidence. Professor Dart (Nature, March 1925) draws attention to 'Bushman' paintings depicting people of Babylonian or Phrygian aspect and some wearing pointed hats like Chinese; many of these figures have light coloured skins. Professor Maingard traces the Semitic origin of a certain number of words borrowed from the Bantus by Bushmen. He attributes this to contact between the Bantus and Sabean navigators and traders.

I. South Eastern Provinces

In the east of the Orange Free State and in Basutoland I have examined a number of magnificent rock paintings. In many of them there are depicted people wearing long, belted tunics and shoes or sandals and carrying broad quivers ; their faces are often white. At Khotsa, in Basutoland, they carry, as well as the characteristic bows and arrows, long banners ending in a triangular shaped fan of ostrich feathers. They are not Bushmen nor Bantus, neither are they Arabs. They are generally accompanied by paintings of large polychrome elands.

Frobenius, in his reproductions of paintings from Natal, shows in several cases clothed figures with white limbs and faces and in some cases they are wearing helmets and heavy clothing.

Mr. Mortelmans has recently discovered in the Drakensberg a painting of two figures with animal heads and wearing long tunics. They are playing wind instruments of a kind (*aulos*) which resembles those known in Greece and also in Egypt.

II. Southern Rhodesia

There are so many resemblances between the art of Southern Rhodesia and the Orange Free State that there must have been some link between the two areas. One cave however, Impey's Cave near Fort Victoria, seems unlike the others. Here nine figures of a white race are depicted. They all have reddish hair cut short in front and at the sides, but falling on to the neck at the back like the hair of a classical Apollo. They are clothed in tight fitting garments with short sleeves. Some of the figures are facing two others, larger than the rest, one of whom is sitting.

Dr. Impey supposed these paintings to be the work of proto-dynastic Egyptians, and I believe them to represent a group of foreigners, engaged in leisurely occupations and not thinking of warfare. The reddish colour of the hair makes them more like Greeks than Egyptians.

III. Damaraland

This old German colony of S.W. Africa is separated from Southern Rhodesia to the east and from the Transvaal to the north by the vast Kalahari desert, about 500 miles wide. Nearly 700 miles separates it from the numerous rock paintings of the Orange Free State.

Mr. Reinhardt Maack published the results of his discoveries of rock paintings in Damaraland in ' Bushman Art, Rock Paintings

of S.W. Africa' (1930) edited by Obermaier and Kühn. A book published in 1932 by Frobenius also contains better reproductions of these rock paintings, drawn by Miss Weyersberg (V. Madzime Tsangata t. II)

The figures from the main shelter of Tsisab Gorge (Leopard ravine) in the Brandberg massif struck me as so interesting that I asked Mrs. Bowler-Kelley, who visited S. Africa in 1937, to obtain photographs of them for me from the actual site. These photographs revealed that the main figure was that of a young woman with a typically Mediterranean, perhaps Cretan, profile.

She is dressed in a clinging garment with a belt ornamented with four rows of pearls. Pearls also decorate her arms, knees, shoulders and breast, while a band of pearls stretches from her ear to her forehead and others again adorn her hair and hang round her neck. Her flesh is white and her hair dark reddish-brown, not quite reaching her shoulders, but cut squarely. A white stain partly hides the high forehead and continues down the long nose. The mouth is delicate and slightly opened and the lips are finely drawn. The chin is hidden in a cloth reaching to the ear. There can be no doubt about the Mediterranean character of the profile. Some of the other figures (men and women) who accompany her also have light skins, hair cut short in front and at the sides and also wear pearl ornaments. Many of them hold bows and arrows and all are wearing shoes.

Above the human figures are depicted seven red and white antelopes, which include oryx, springbok and only one eland. There are other earlier paintings both of humans and animals, executed in a much cruder style.[1]

Conclusions

Archaeological excavation, in shelters containing rock paintings has only rarely been carried out. Paintings in South Africa have, however, constantly been found connected with ' Late Stone Age ' microliths and sometimes there is a sub-stratum containing late ' Middle Stone Age ' industries of Moustero-Solutrean type.

This latter stage at Bambata (Southern Rhodesia), which was also accompanied by much yellow ochre, was thought by Messers Neville Jones and Leslie Armstrong to have been contemporary with the oldest paintings in this shelter. The rest of the paintings they associate with the Wilton industry.

I believe the ' Middle Stone Age ' to be the period when many

[1] This site was completely copied by the author in 1947 and partly published: S. African Archaeological Bull. 1948, No 9.

Fig. 1. Paintings in Impey's Cave (Fort Victoria), showing white people of Greek type, in superposition on older paintings of animals and men. The reddish hair is cut in the style of the archaic Apollos. After Frobenius.

Fig. 2. Single file of men carrying shot gazelles. Their heads are those of conventional antelopes in white. Note the clothing with jackets, trousers, leggings and shoes. They are partly older, partly contemporaneous with the polychrome antelopes, and later than the big white animals and other figures.
Rock shelter of Mditima, Drakensberg (Natal). After Frobenius. [*To face p.* 236

Fig. 3. Four men clad in heavy cloaks, their wide turned back collars heavily embroidered ; two of them wear helmets ; their weapons look like javelins. National Park, Drakensberg (Natal). After Frobenius.

Fig. 4. A young woman with Mediterranean profile. Tsisab Gorge, Brandberg.

of the rock paintings were executed. This period antedates the formation of the last black earths (Vereeniging) and is subjacent to the thick stalagmites of the Makapan caves, which are contemporary with the last major Pluvial.

This evolved stage of the 'Middle Stone Age' descends below the level of the modern beaches, while the early stages of the 'Middle Stone Age' are rolled in the old 20–45 feet beach level at Mossel Bay, which occupies the position of our beaches of the last interglacial.

This leaves the whole post glacial period for the 'Late Stone Age' and for the development of cave art and it is the period when most of the paintings were done. Artists during this time were no doubt influenced by contacts with visitors from Knossos, Greece and Egypt, and others of the Persian Gulf, few of whom have left any trace in written history.

In the course of the discussions which followed this paper, some of my colleagues pointed out that during initiation ceremonies such as are performed by the Bantus to-day, natives dress themselves in complicated garments and often paint their skin, with white pigment especially. I am fully aware of these facts, but the paintings mentioned are always earlier than any representations of Bantus and the animals do not give the impression that these paintings have been influenced by Bantu customs, as neither cattle, nor shields and assegais are represented with them. It is probable that the artists who did these most ancient frescoes lived before the arrival of the Bantu.

In any case, I do not think that this explanation of present day native initiation costume applies to the figures I have mentioned, especially those of Brandberg and Impey's Cave.

Thursday, January 23rd

NEOLITHIC POTTERY IN DAKAR

R. Mauny

THREE CULTURES WITH EARLY POTTERY AT THE JUNCTION OF THE BLUE AND WHITE NILES

A. J. Arkell

This paper has been covered by 'Early Khartoum' (O.U.P., 1949) and added to by 'The Excavation of a Neolithic Site at Esh Shaheinab, Sudan (1949)' in Proc. Prehist. Soc. 1949, pp. 42–49.

RECENT DISCOVERIES AT MAADI, NEAR CAIRO

M. Amer Bey

The excavations at Maadi conducted by the Fouad I University, Cairo, have given very fruitful results in the last few seasons and have thrown a good deal of light on the cultural conditions prevailing in the Delta of the Nile immediately before the beginning of the Historic Period and the rise of the Dynasties. Although the area excavated is nearly 10.5 acres, there still remains an equal if not a larger area to dig both in the extreme eastern and extreme western portions of the settlement. To this must be added the newly discovered Cemetery, which lies to the south of the settlement, and which we have come across only lately, although the seach for it has been going on since the excavations first started in 1930–1931. Out of the Cemetery a good deal of material is expected to be revealed, and the anthropological study of the skeletons is sure to increase our knowledge of the racial composition of the Delta during the final phase of its evolution in Prehistoric times.

Another important find in the settlement area is the existence of four deep caves sunk in the ground, which, no doubt, served the purpose of dwellings or shelters of some kind. Some of them are as much as 2.5 metres deep, and nearly two metres wide ; they are supplied with steps cut in the sandy soil, reinforced by lumps of rough limestone blocks. Post-holes exist in their floors, showing that they were, at least partly, roofed, and that their inner walls were covered with matting to prevent the falling in of the sand from the walls. One cave is especially worthy of note. Its walls are covered partly with rough limestone blocks and partly with what seems to be the earliest attempt at making sun-dried bricks. This, to the best of our knowledge, is the earliest known example of rough stones and bricks being used in buildings in the Delta.

Turning to portable finds, the most important new additions include a good number of fan-shaped scrapers, some being of considerable size, and all showing contact with Palestine, and a few implements made of natural rock crystal. Not less important are the few mace-heads discovered, the majority being of the plano-convex type. To these may be added some valuable polished black stone axes, as well as two precious copper axes of rectangular shape together with lumps of copper ingot. One must also mention the ever increasing number of the peculiar yellowish pots with handles, and the few complete painted vases, of which sherds only existed in the early seasons.

The new objects in wood include two nicely preserved plates

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of fine workmanship and a fragment of boomerang. A wonderful collection of stone vases, of various shapes and sizes has also been revealed. Some are of limestone or alabaster, while others are of basalt, granite, gneiss or diorite. All these are new objects as far as the Predynastic of the Delta is concerned, and all are valuable material in the study of the early cultural relations between southern and northern Egypt.

To the above, we must finally add two red pottery objects, one being a fragment of a model of a boat, and the other the head of a statuette showing a racial type not uncommon, even in our own days, in the countries lying north-east of the Delta.

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